PRICE 50 CENTS

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

OCTOBER 24, 1955

Planer-router from the makin's—see page 2

How to Work Superalloys—A SPECIAL REPORT

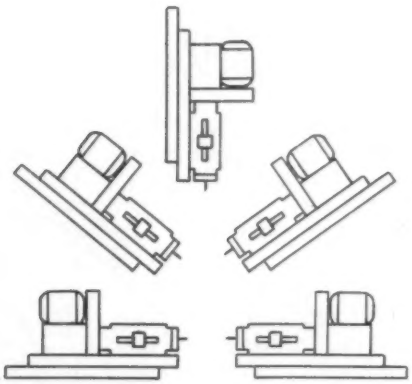
Caterpillar Tractor Replacement Policy

A NEW HIGH IN PRODUCTION EFFICIENCY

new

HEALD SLIDE UNIT BORE-MATICS

approach any borizing problem
from the **RIGHT ANGLE**



Slide Units can be easily arranged to approach the work from any desired angle. Multiple stations can be combined on a single base with identical or consecutive operations at each station, for maximum production efficiency.

With the new line of Heald Slide Unit Bore-Matics, the machine can be adapted to the work—not the work to the machine. For these compact, hydraulically operated Slide Units, complete with boringhead and drive, can be arranged to approach the work from any desired angle—vertically, horizontally, or at any inclination best suited to the operations being performed and the nature of the work. That means greater adaptability to your specific job requirements. It means more efficient floor-to-floor cycles and higher production per machine-hour.

The two-station Vertical shown above is a typical example of modern Slide Unit design—boring, facing and chamfering aluminum torque converter housings at 88 parts per hour, gross. For the newest developments in precision finishing, IT PAYS TO COME TO HEALD.

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Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts
Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York ®

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American Machinist

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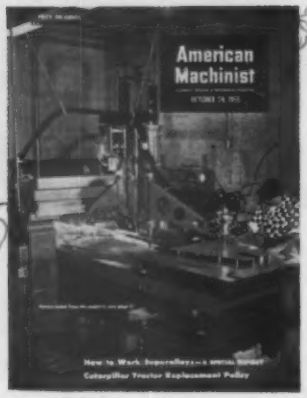


chips

Planer-router . . . Island Machine Co, Farmingdale, LI, NY, is a jobbing shop specializing in short-run medium-size aircraft parts. To do this work efficiently, the company has built up a series of special machines, based on rebuilt familiar standard machines or parts. On our cover, for example, is a router built from a Fitchburg miller base, with planer rails and a home-made router head. Base gear trains and leadscrews were replaced by hydraulic drives. A Tru-Trace 3-D tracer head has been added, is used on 80% of jobs . . . An article in this issue describes this and other machines—mostly spar and skin millers similarly combined.

Superalloys . . . A new and varied group of materials have useful properties above 1200 F. Many are considered unmachinable, but only relatively—if you have to machine 'em, you can. Our current Special Report is an effort to combine and correlate present practice for various types on machining, forming, forging, welding, and heat treatment. As in our early Reports on aluminum, magnesium, titanium, and zirconium, data are preliminary in many cases.

Probable . . . As quality control, self resetting, and feedback have come along, there has been more and more reference to probability. For most of us, it's just a word that recalls something in math years ago. It was for our executive editor, too, so he has dug around and comes up with an exposé for lay engineers. We hope it helps.

Brazing . . . Everything is being automated these days, and brazing is no exception. To prove our point, we've gotten C A McFadden of Selas Corp to round up some pictures and data on outstanding examples of the trend.

Plantkeeping . . . On a recent visit to the Marietta (Ga) plant of Lockheed, one of our editors was struck with the obvious cleanliness and neatness. Now L D Myers, plant engineer there, tells how it is done, and the savings from the "war on the Dirty Bird." Here again are ideas for your own plant.

Sub-zero . . . We've been hearing for some time that stainless can be formed better after sub-zero treatment—and is stronger. At long last, we can tell you more. If the stainless is processed at low temperatures, says Richard E Paret of the AISI, its strength will increase markedly — and stay up at room temperature.

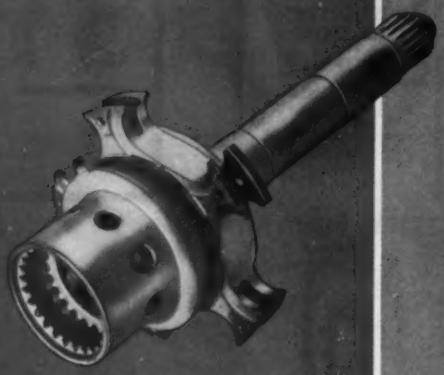
Vibration Cleaning . . . We've heard a lot about ultrasonic cleaning —but here is a different approach. Roy Armstrong of Bell Aircraft tells how cleaning is done by vibrating work within the sonic range —up to 55 cps—while cleaning fluid is pumped through it. The idea works particularly well on valve bodies which couldn't be cleaned well any other way—even ultrasonically.

Coming . . . Nov 7 *AM* will include a Special Report on finishing stainless, plus a series of short, but potent, articles. Among subjects are: forming titanium, salt-hardening of axle shafts, screw-machine tooling, planing, welding with big fixtures, making motor laminations, and several others. The result is an issue full of ideas.

PLANNER . . . E L Breese, planning manager at the Caterpillar Tractor Co Peoria plant, joined the firm in 1940 and entered the company's machinist-apprentice course in 1941. In 1942 and 1943 he served as a job instructor in the training course, and in 1943 was promoted to a machine-shop foreman. He then became machine-shop general foreman in 1946, a machine-shop superintendent in 1948, and Peoria plant scheduling manager in 1952. Breese was Caterpillar's production manager at Peoria from 1953 until he assumed his present position as planning manager in 1954. He is a member of the Society of Industrial Engineers and the ASTE. His explanation of Caterpillar replacement policy appears in this issue.

COMING . . .
in Mid-November . . .
the
1956 Planbook issue
with
"Nuggets" and
a very special report
"How to work non-ferrous metals"
watch for your copy

Pinion carrier for an aircraft planetary reduction gear.



Impeller shaft for aircraft supercharger.

Aircraft cam gear.

Breech block for an automatic rifle.

The Gleason No. 26 Quenching Press for parts up to 25″ in the maximum dimensions.

The Gleason No. 140 Quench Machine for shafts and similar parts 5/16″ to 4″ in diameter, up to 43″ in length.

How to hold parts like these to close tolerances during quenching

Are you troubled by warpage or distortion of precision parts during hardening?

If you have this problem, Gleason Quenching Equipment can help solve it with substantial savings in costs.

This equipment provides automatic, controlled quenching of flat, round, irregular, or shafted parts insuring alignment and minimizing distortion.

For round, flat or irregular parts up to 36″ in the maximum dimension there are three sizes of Gleason Quenching Presses of the type shown at the top right.

For shafts or similar parts there is the Gleason Rolling Quench Machine, shown at lower right. It accommodates shafts from $\frac{9}{16}$″ to 4″ in diameter, from 6″ to 43″ in length, and can handle parts with integral cams, gears or shoulders up to 8″ in diameter.

In all these machines the heated part is held under pressure. Flow of the quenching fluid to each portion of the heated part is accurately controlled at preset rates during all stages of the quenching cycle.

In the Quenching Presses precision dies hold the part in alignment and direct the flow of quenching medium during the quenching cycle. In the Rolling Quench Machine the part is rolled under controlled pressure. Relative pressures applied to the various portions of the part are accurately and automatically controlled.

The use of Gleason Quenching Equipment eliminates the need for any subsequent straightening. This is important for two reasons: (1) It saves one operation, reducing production costs. (2) Hardened parts which do not require straightening have less residual stress. Further information will gladly be sent on request.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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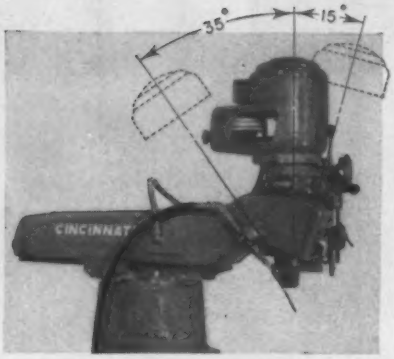
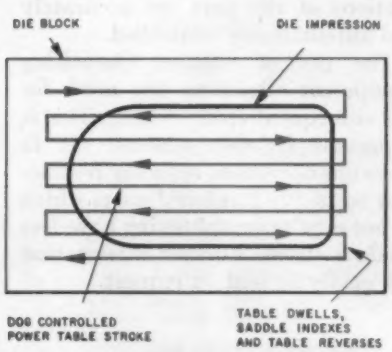
NEW



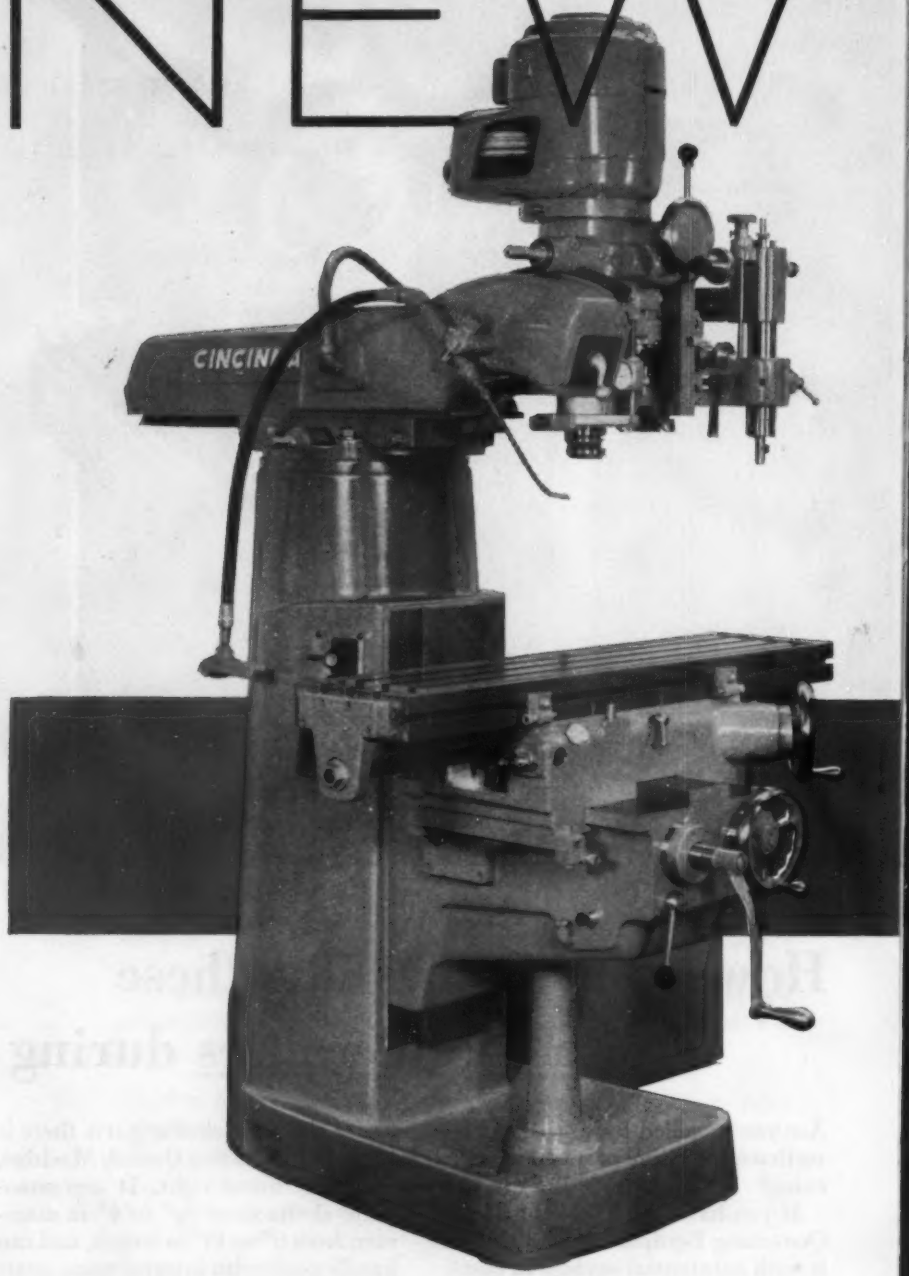
Spindle head and tracing mechanism may be swiveled as a unit about a pivot point which approximates the cutting end of the cutter.

Automatic Hydraulic Depth Control unit. The tracing finger lightly contacts the master, and the cutter head automatically follows exactly the same vertical displacement.

Shaping Attachment, mounted on rear end of cross ram, may be quickly swiveled to working position. The attachment is removable; individually motor driven. (extra equipment)



The Contourmaster becomes an automatic die sinker when equipped with Automatic Table Cycle and Automatic Pickfeed to Saddle.



Contourmaster, a new die sinking machine developed by Cincinnati Milling, is a member of the world's greatest family of hydraulic tracer controlled machine tools. The new Contourmaster is built in two styles, 1A and 1B, differing primarily in table size and location of handwheels. Both styles are equipped with Cincinnati Hydraulic Automatic Depth Control, which operates from a few ounces of contact pressure . . . three-dimensional positioning of tracer mechanism . . .

CONTOURMASTER

. . . master of your small to medium size tool and die work

No. 1B CONTOURMASTER

(right- and left-hand views). ***Range:*** **22" table traverse; 10" cross traverse of saddle. Front handwheel table control. Style 1A same as 1B except 16" table traverse and handwheels at end of table.**

ram mounting of spindle carrier for increased cross range . . . heavy duty saddle-knee-table design. These features and many others are combined in a great new CINCINNATI . . . the Contourmaster . . . master of all small- to medium-size tool and die work. Get the complete story by writing for catalog No. M-1919.

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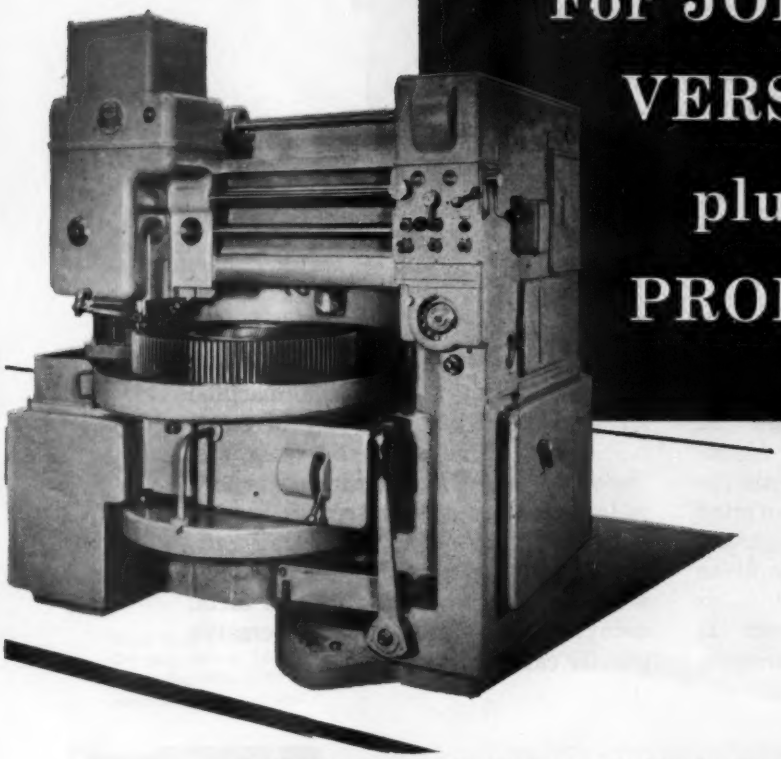
For JOBBING VERSATILITY plus HIGH PRODUCTION



HERE'S versatility that pays dividends. For the Fellows 36-Type Gear Shaper has real "earning power"... whether used to handle virtually every job that comes up in a small gear department... or concentrated upon the heavy work in a large production shop.

A powerful, ruggedly constructed, heavy duty machine, the 36-Type can take extra heavy cuts at high speed... yet hold close limits. Low set-up time, fast gear-shift change from heavy to fine feed, quick dial adjustment from one cutter-spindle speed to another... these are just a few of the ways the 36-Type keeps down costs.

Ask your Fellows Representative to explain *all* the profit-making advantages built into the 36-Type... as well as the Fellows Plan for deferred payment. Write, wire or phone any Fellows Office!

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VAN NORMAN
DIVERSIMATIC®
CENTERLESS GRINDER

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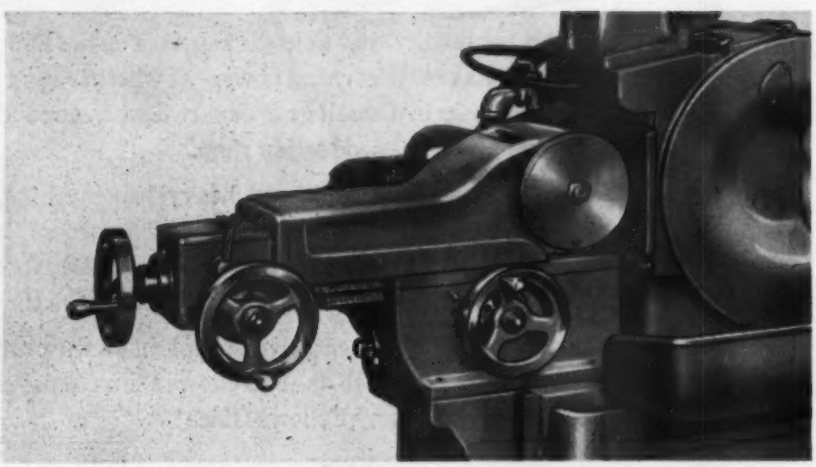
The Diversimatic is an ideal machine for grinding a great variety of small parts made of metal, plastic, glass, etc. Especially suited for grinding parts used in business and office machines, sewing machines, electrical appliances, aircraft, automobiles, munitions, and similar work. Call, write or wire for full facts, today. See for yourself how this versatile grinder can cut your costs.

EXCLUSIVE
CRUSH - DRESSING ATTACHMENT INCREASES SCOPE OF GRINDING OPERATIONS



It crushes the wheel to the desired contour, and holds the form, allowing hundreds of pieces to be ground between wheel dressings, imparting the exact profile to the work.

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Work Size: 0-1½" Diam.
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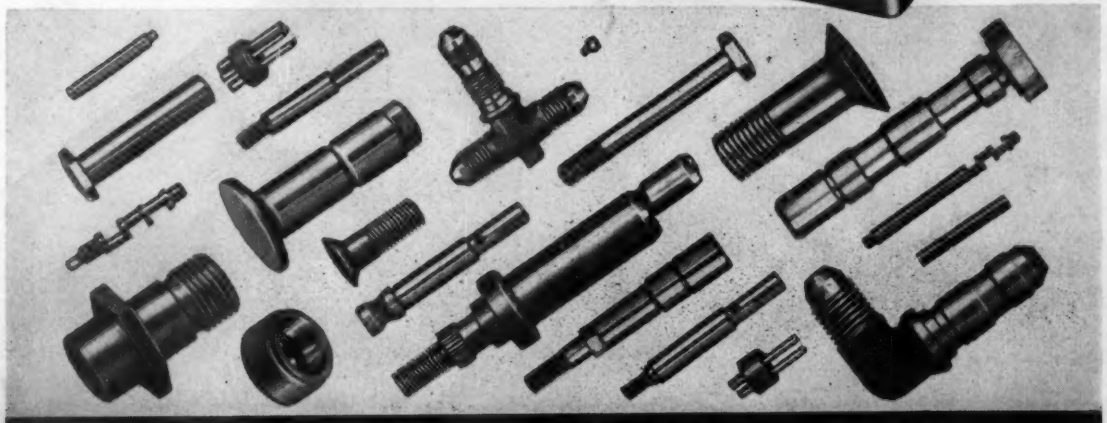
Regulating Wheel: 8" O.D. x 4" wide
Automatic cycle optional



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Don't wait . . . for extra profits install a Van Norman Machine now!
They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

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3/8" Machine

threads 500 pieces per hour

THE WORLD'S LARGEST MANUFACTURERS OF THREADING EQUIPMENT

A LANDIS 3/8" Threading Machine has increased the output of threaded automobile seat lock rods by 25%.

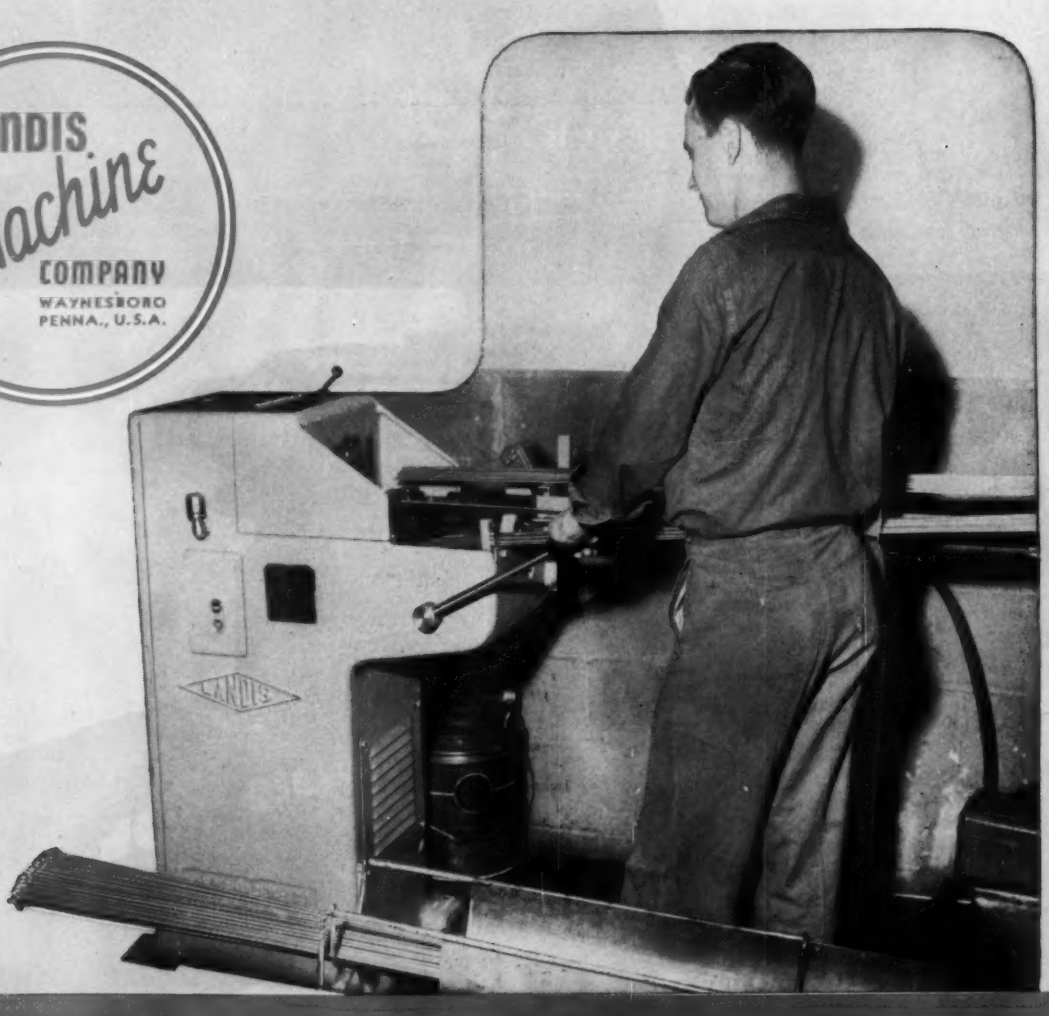
#10 24-pitch UN threads are cut 1¾" long on 54" galvanized wire rods. Production now averages about 500 pieces per hour, with 4,500 pieces threaded between grinds of the chasers. With excellent production between chaser grinds, low tool cost and minimum downtime are assured through the use of long-life LANDIS Tangential Chasers which can be reground for 80% of their original length.

These savings are being realized at Mid-West Wire Products in Detroit, Michigan. Best previous threading methods never produced more than 400 pieces per hour, and completed only 2,500 pieces before requiring the chasers to be reground.

The 3/8" Machine is a small high-speed machine for threading small parts (3/16" to 1/2" in diameter) to precision tolerances. This machine has been designed so that it can be operated with only one hand, freeing the other hand for loading and unloading the workpiece. The opening and closing of the grips is automatically controlled by the carriage operating lever, and the die head automatically opens on completion of the thread and closes during the carriage return.

Analyze the threading operations in your plant today for the possibility of a similar production saving. Then send us the specifications of the workpiece involved, and ask for Bulletin H-91 for more detailed information about the LANDIS 3/8" High Speed Threading Machine.

LANDIS Machine COMPANY
WAYNESBORO
PENNA., U.S.A.



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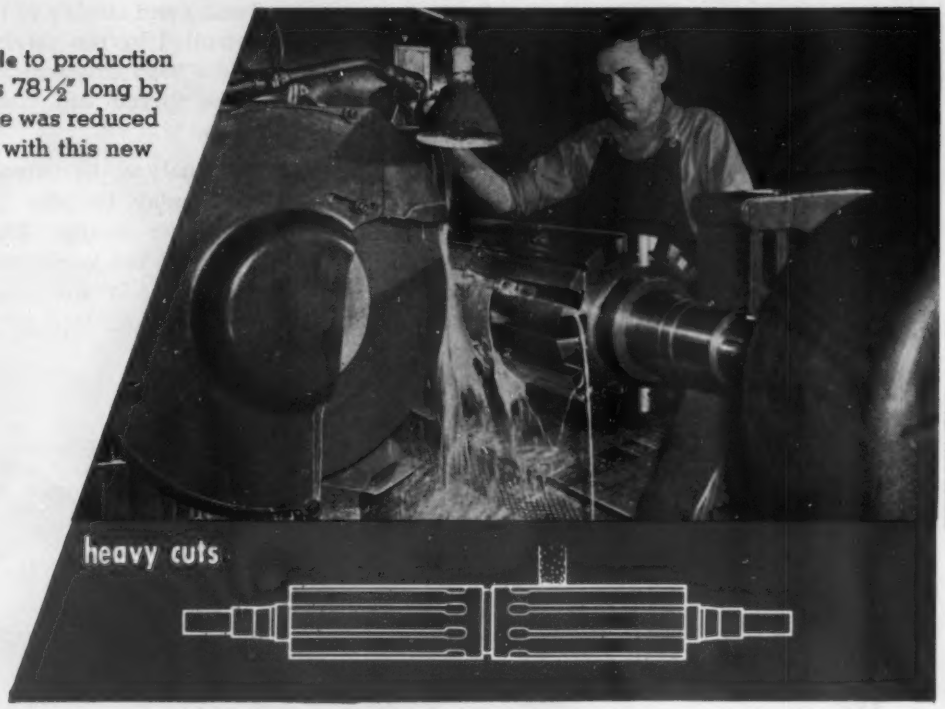
CUTTING - TAPPING - GRINDING - ROLLING

You Can Get Results Like These

from modern Landis

heavy cuts

Interrupted cut no obstacle to production of these slotted cylinders 78½" long by 13⅝" O.D. Grinding time was reduced from 7 hours to 6 hours with this new Landis grinder.



LANDIS 24" x 120" type FR Roll Grinder
Detailed specifications in Catalog F-48.
Send for your copy today.

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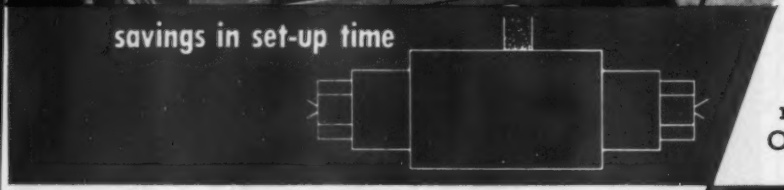
precision grinders

type FR Roll Grinders . . .

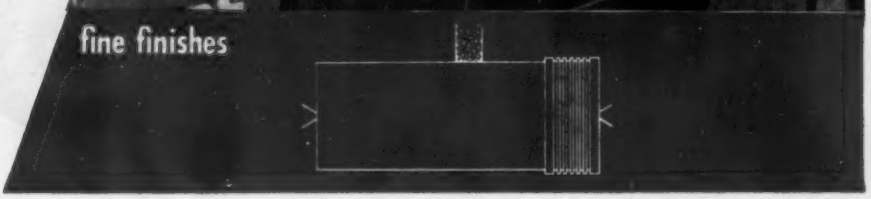
savings in set-up time

Regrinding roll for cold rolling operations. Patented crowning mechanism insures exact duplication of crowning setting on every job. Rolls have 20″ face and are 12″ O.D. Grinding time is 20 minutes floor-to-floor.



fine finishes

.040" stock removal to 6 micro inch finish are requirements for grinding this 32⅝″ long by 13″ O.D. main ram. Floor-to-floor time is 4 hours.



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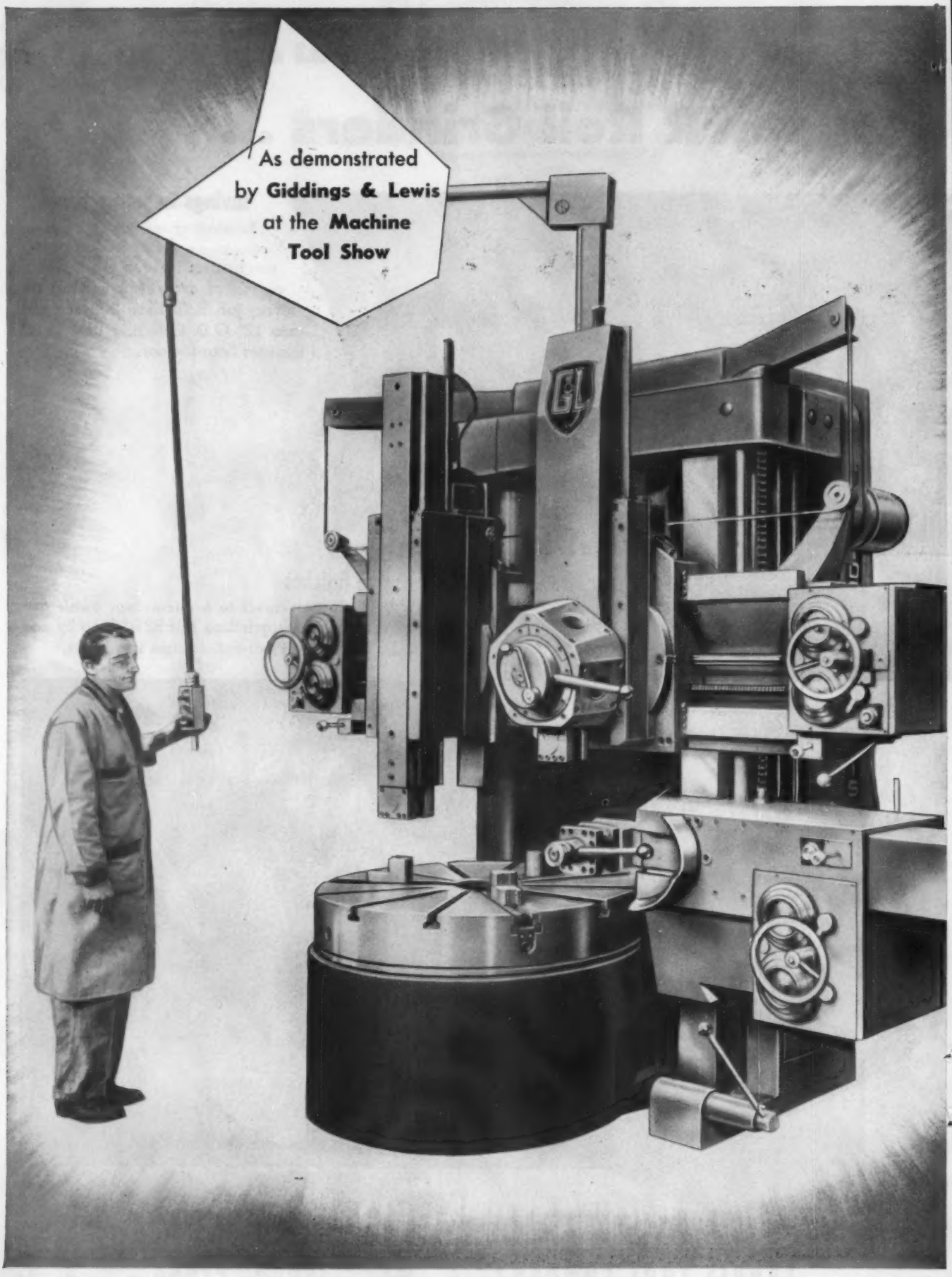
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by Giddings & Lewis
at the Machine
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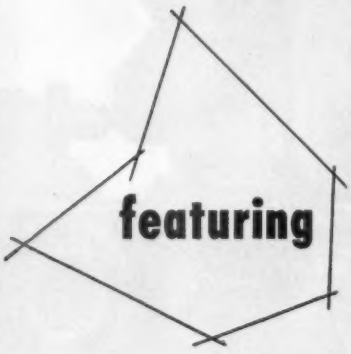
the ALL NEW Giddings & Lewis

42″ Vertical Turret Lathe



- ✓ **"joy stick" directional control and instant powered remote-control shift**
- ✓ **ability of machine to change table speeds in-the-cut or on-the-fly**
- ✓ **feed box with two working ranges of 16 feeds each**
- ✓ **constant cutting speed attachment (optional) giving 16 direct feet per minute rates**
- ✓ **each head with independent feed and traverse and directional controls to both ram and saddle**
- ✓ **several types of ram heads (fixed or swivel) and various table arrangements**
- ✓ **special attachments (optional) for thread cutting and geared taper turning**
- ✓ **swiveling turret and ram heads counterbalanced for easy motion under feed and traverse and for swiveling**
- ✓ **jet-lubrication to main spindle bearing with main motor drive. All machine elements and associated feed units are automatically pressure lubricated when in motion.**

HERE'S the Giddings & Lewis highly-versatile, new 42″ Vertical Turret Lathe. And if you saw this machine in action at the Machine Tool Show, you'll agree that its revolutionary new design features are the latest — never before offered on any other Vertical Turret Lathe.

Listed above are only a few of the many outstanding features you get—improvements that permit high-speed, multiple machining operations in a single setup. For example, the centralized controls with standard coaxial micrometer dials and circular scales and "joy stick" directional control of feed and traverse, assure you greater accuracy at high speeds, simplicity of operation and reduced operator fatigue.

This all new G&L machine offers you even greater versatility with its choice of various standard heads — available as swiveling turret (five-station) or swiveling ram rail heads and side head. These specially-designed heads can be used in any combination for rough and finish machining of small or large workpieces.

Another important, versatile feature includes standard table arrangements — available in plain, three- or four-jaw combination or powered chucks. Powered by a 50-hp motor drive, the table provides variable speeds from 6 to 320 rpm in 24 geometric steps in two ranges and feeds between .0007″ and .576″ in 20 geometric steps. What's more, the operator can change table speeds in fly or on cut — saving machining time and extending tool life.

For more information on the outstanding features of Giddings & Lewis new 42″ Vertical Turret Lathe, be sure to see your nearest G&L representative. He'll be glad to give you all the details and tell you what this versatile, economical machine can do for you.

GIDDINGS & LEWIS MACHINE TOOL CO.

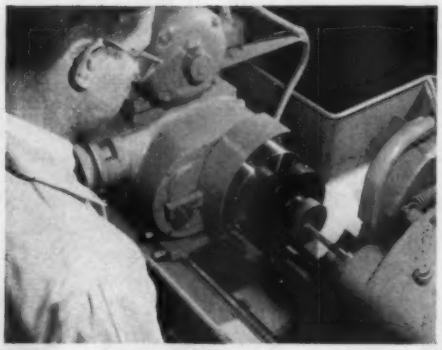
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; Upright and Radial Drilling Machines; and Davis Boring and Cutting Tools.

Improve Your Precision Toolroom Grinding with NEW

FILMATIC

FILMATIC grinding wheel spindle bearings . . . never wear out; never require adjustment



Internal grinding head . . . always in place and ready for the job; dozens of quills, spindles and collets to choose from

CINCINNATI

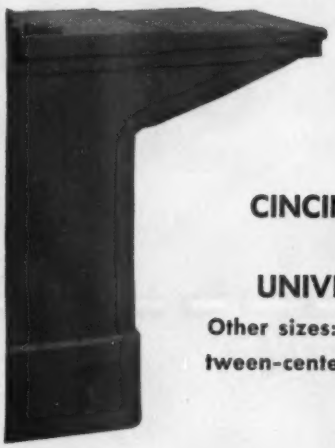
CENTERTYPE GRINDING MACHINES
CENTERLESS LAPPING MACHINES •

In Three Ways

Cincinnati Filmatic Universal Grinding Machines

CINCINNATI

It's difficult to improve upon top performance, but it can be done. In toolroom grinding, for example, the *new* CINCINNATI FILMATIC Universal Grinders offer three-way improvement:



CINCINNATI FILMATIC
12" x 36"
UNIVERSAL GRINDER

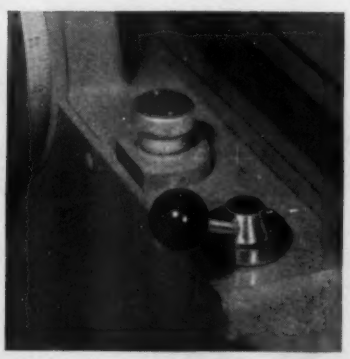
Other sizes: 14" and 18" swing. Between-center lengths: 36", 48", 72"

1 *Improved accuracy.* A new cross feed unit assures closer accuracy than ever before on your precision toolroom work; automatic pickfeed to a positive stop; .000050" minimum increment of adjustment.

2 *Improved convenience of operation.* Table and cross feed handwheels are raised to a more comfortable height; handwheels are larger; new headstock speed selector is easier to operate; push buttons are relocated for easier accessibility.

3 *Improved versatility.* Hinged internal grinding head, a Cincinnati original, has been retained and improved upon with lifetime lubrication and a wider selection of quills, spindles and collets; pickfeed at either end or both ends of table cycle; power rapid positioning (extra) for wheelhead.

Cross feed unit . . . completely new; two-speed; pickfeed all the way to final size



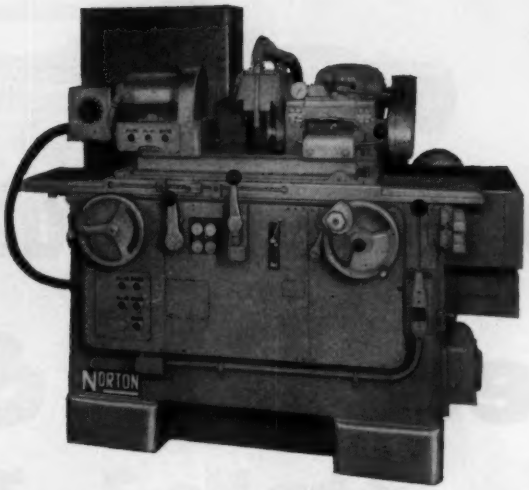
Power rapid positioning . . . eliminates tiresome hand cranking from one diameter to another

Don't forget, the above improvements in the three major requirements for precision toolroom grinding are in addition to other well-known Cincinnati advantages such as FILMATIC grinding wheel spindle bearings. That's why CINCINNATI Universal Grinders are your best buy. Get all the facts by writing for catalog No. G-663.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

• CENTERLESS GRINDING MACHINES
MICRO-CENTRIC GRINDING MACHINES

TUN



New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton offers you such long experience in both grinding wheels and machines — to help you produce better products at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

Top quality at low cost...

Kearney & Trecker

3 hp No. 2 — 7½ hp No. 3

Model CE

plain and universal milling machines

Designed specifically for EFFICIENCY, EASE and ECONOMY of operation

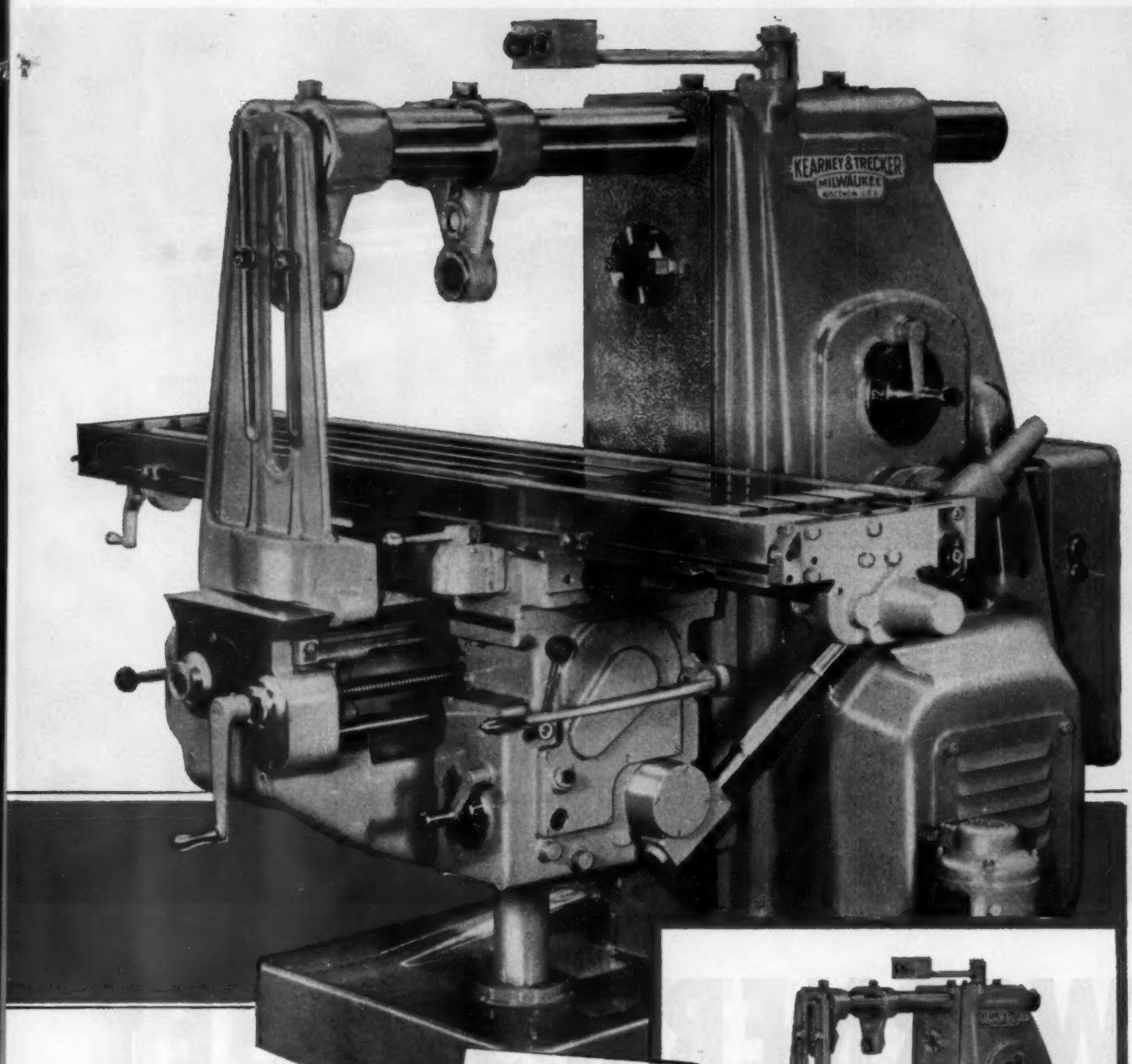
HERE'S Kearney & Trecker's answer to industry's need for a new milling machine that combines quality with *low initial cost*. The new Model CE's give you the three most wanted features — *Efficiency*, *Ease* and *Economy* of operation. What's more, these machines can be obtained under Tool-Lease.

The economical Model CE's are available in either No. 2 (3 hp) or No. 3 (7½ hp) size — both in plain and universal styles. The CE's feature 16 quick-change speeds (25 to 1300 rpm) and feeds (½ to 25 ipm). They are ideally suited for a wide variety of applications — especially for small tool shops, repair and maintenance shops and vocational training schools.

For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN



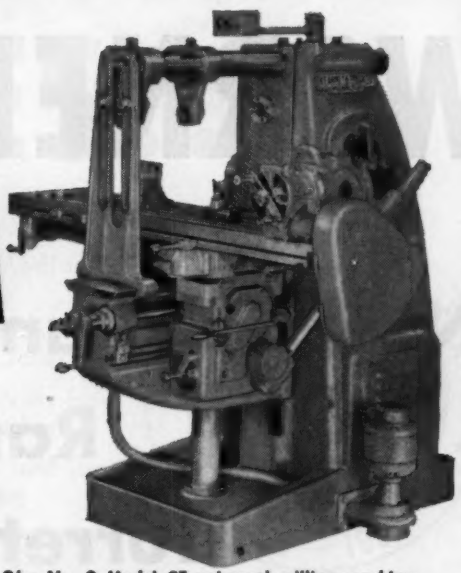
7½ hp No. 3 Model CE plain milling machine

NOTE: Standard equipment includes choice of only one arbor support. Overarm brace available at additional cost.

available for **TOOL-LEASE**

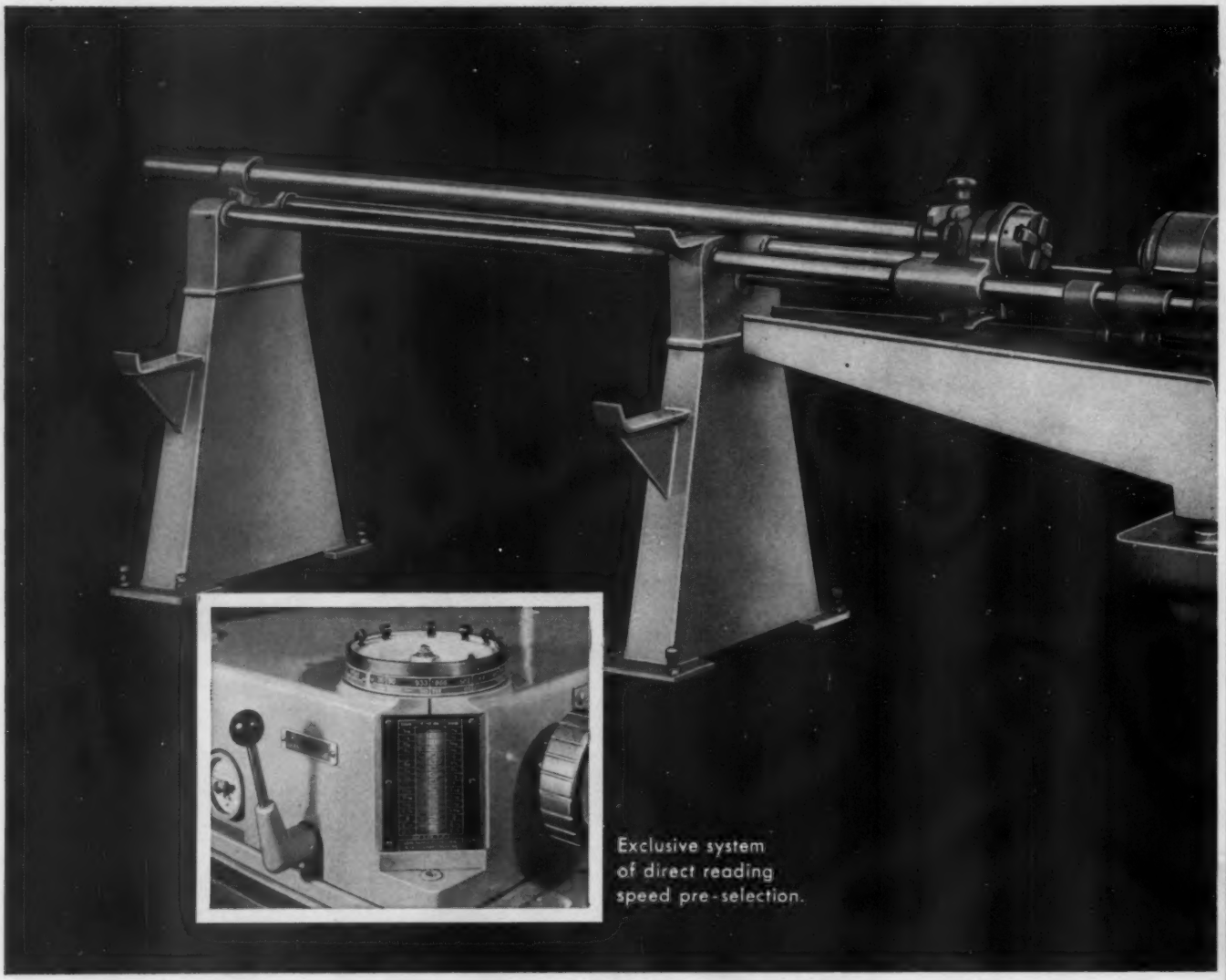
FREE CATALOGS!

Ask for complete data on Model CE milling machines, catalog No. CE-10, and for Tool-Lease bulletin, TL-10A. Also see our catalog in Sweet's. Write or call Kearney & Trecker Corp. — Telephone: GReenfield 6-8300.



3hp No. 2 Model CE universal milling machine

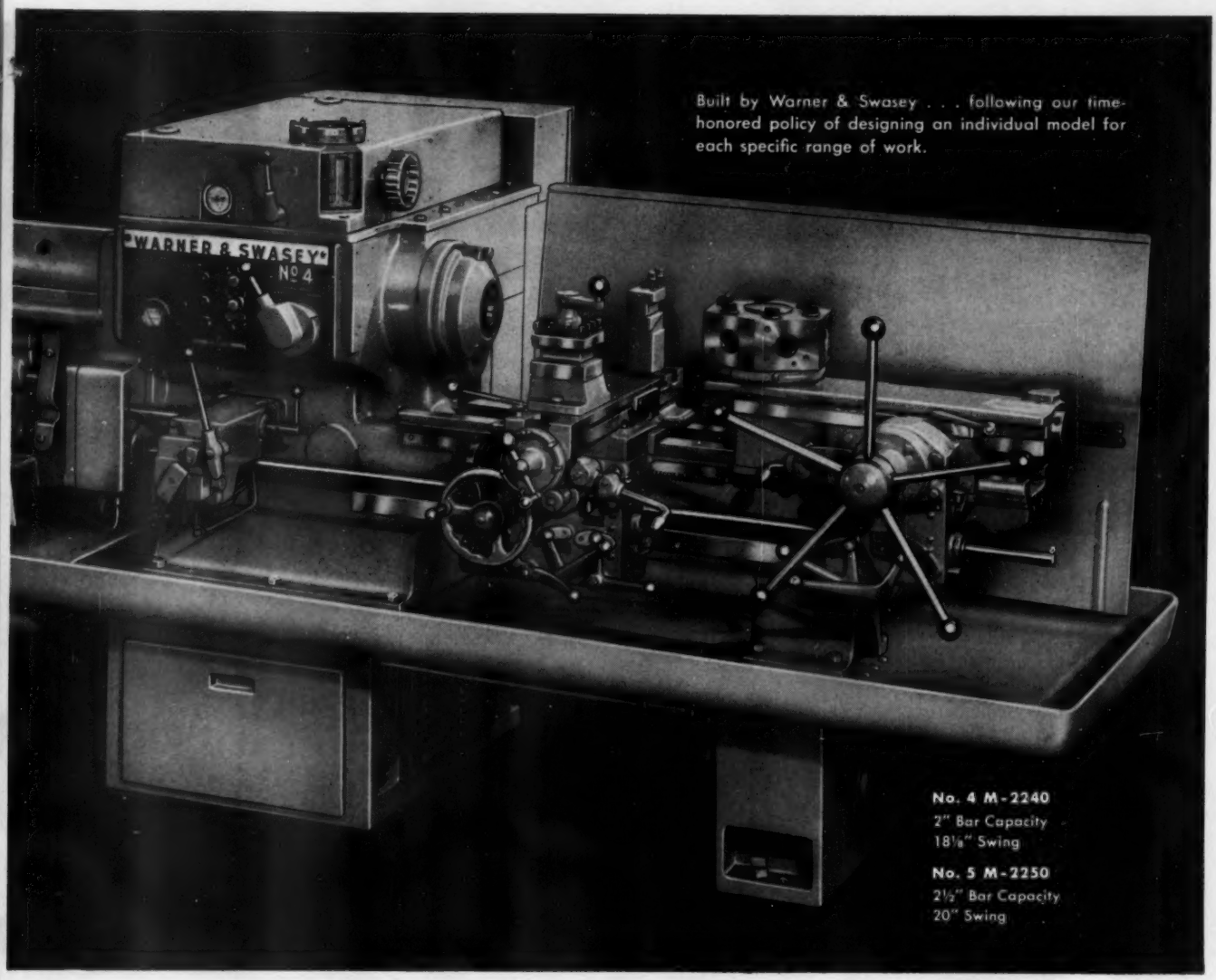
NOTE: Standard equipment includes choice of only one arbor support. Only Conventional Lead Attachment (shown above) is available in Model CE Universal machines. Overarm brace available at additional cost.



WARNER & SWASEY

New No. 4 and No. 5 Ram Type Turret Lathes

- Higher Speeds
- Instantaneous speed changes—sliding gears eliminated
- Direct-acting hydraulic clutches—need no adjustment
- Smooth, quiet running, helical high-speed gears
- Short, stubby shafts—anti-friction bearings throughout
- Single lever control for forward, reverse, brake and free spindle
- One lever control for speed



Built by Warner & Swasey . . . following our time-honored policy of designing an individual model for each specific range of work.

No. 4 M-2240
2" Bar Capacity
18⅛" Swing

No. 5 M-2250
2½" Bar Capacity
20" Swing

INTRODUCES...

changes and 6:1 ratio high-low shift

- Two-speed motor provides 24 *unduplicated* speeds, forward and reverse, with a 62.5 to 1 over-all range
- Flange-mounted, direct-drive motors—no belts
- Patented direct-reading speed pre-selector—calibrated in rpm's, surface speed and work diameter
- Rigid, heavy-duty, high speed hydraulic bar feed with adjustable feed-out
- Single lever control for hydraulic collet chuck and bar feed
- Zoned operating controls for effortless machine operation
- One-piece head and bed for greatest possible accuracy
- Larger, separate oil sump provides cooler filtered oil
- Retains Warner & Swasey standard tooling interchangeable with your present models

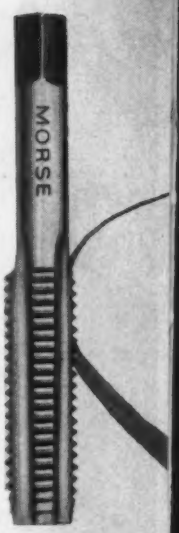
75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

New MORSE "Vectormatic" Taps

are Electronically gaged and inspected

. . . while they're being ground!

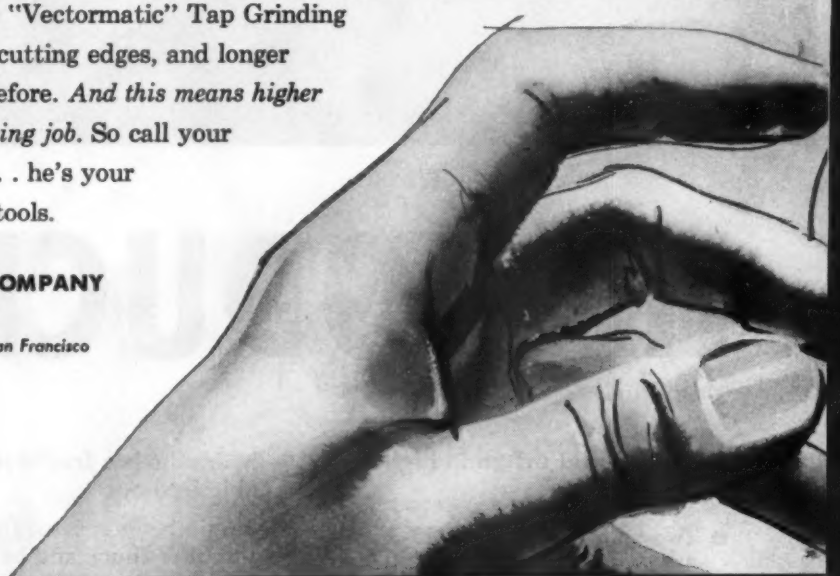


"HANDS OFF" is right! In the whole operation, the work is never touched by the operator or the gaging mechanism.

The tap is sized by the exclusive Magic-Mike control. Size control mechanism and the adjusting segment of the circuit are completely locked in, to insure uniformity.

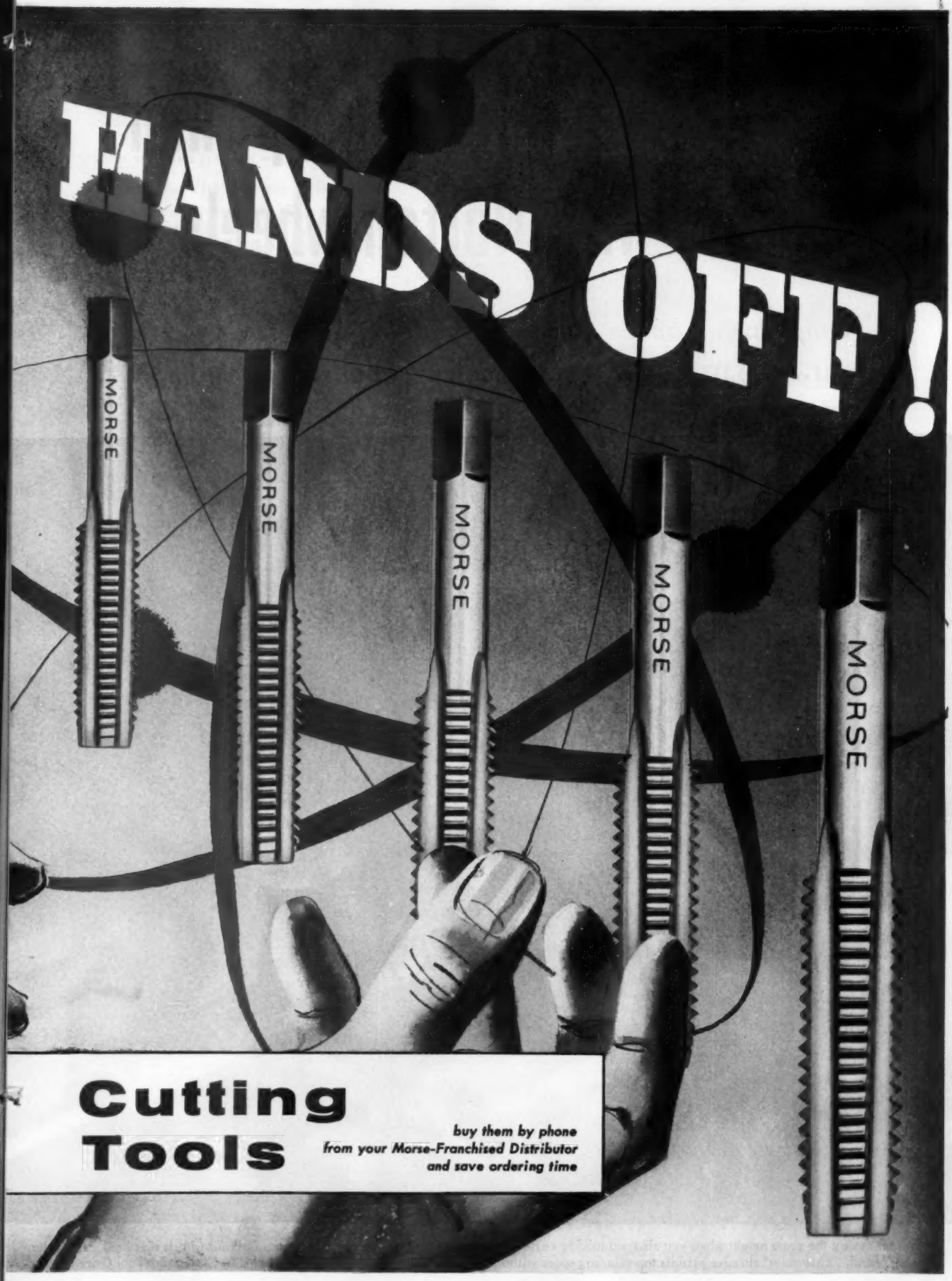
The gaging mechanism is controlled by *an invisible wall of electrons* activating a series of relays. And the control mechanism is unaffected by voltage fluctuations and vibrations.

These and other features of Morse "Vectormatic" Tap Grinding give you far smoother finish, keener cutting edges, and longer tap-life than you have ever known before. *And this means higher production at lower cost, on every tapping job.* So call your Morse-Franchised Distributor *now* . . . he's your only source for these incredible new tools.



MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE


HANDS OFF!
MORSE
MORSE
MORSE
MORSE
MORSE
Cutting Tools
buy them by phone
from your Morse-Franchised Distributor
and save ordering time

Tools – and operators – keep their tempers with Norton wheels

Only Norton builds these value-adding, time-saving "TOUCH of GOLD" features into wheels for tool room grinding

All teeth stay the same height when you sharpen milling cutters with long wearing, free cutting Norton G Bond wheels that hold size all the way round. 32 ALUNDUM* abrasive permits top grinding speed without burning. The machine is a Norton No. 20 Cutter and Tool Grinder.

No other wheels for tool room grinding are made the way Norton makes them. Exclusive precision processing gives them unusual advantages, including controlled uniformity and built-in balance, that reduce vibration and assure smoother running wheels.

Plus The Famous G Bond

Also, you can get these wheels in the most efficient vitrified bond ever produced — the Norton G Bond, developed especially for precision-grinding the hardest tool steels. Holding the abrasive particles just long enough for maximum cutting action, G Bond wheels: *cut freer, cooler, faster . . . do more work per wheel and cover a wider range of jobs . . . hold corners better, dress easier and grind more pieces per dressing.*

And for rapid stock removal, with especially cool cutting action, Norton 32 ALUNDUM* abrasive is outstandingly popular. With all G Bond wheels you can take heavier cuts in expensive, heat-sensitive steels without drawing temper. They'll reduce tool spoilage, give you closer tolerances and smoother finishes, with fewer wheel changes and machine adjustments — additional "Touch of Gold" benefits that mean better performing tools and better, lower-cost tool room grinding than you ever got before.

For Your Carbide Grinding

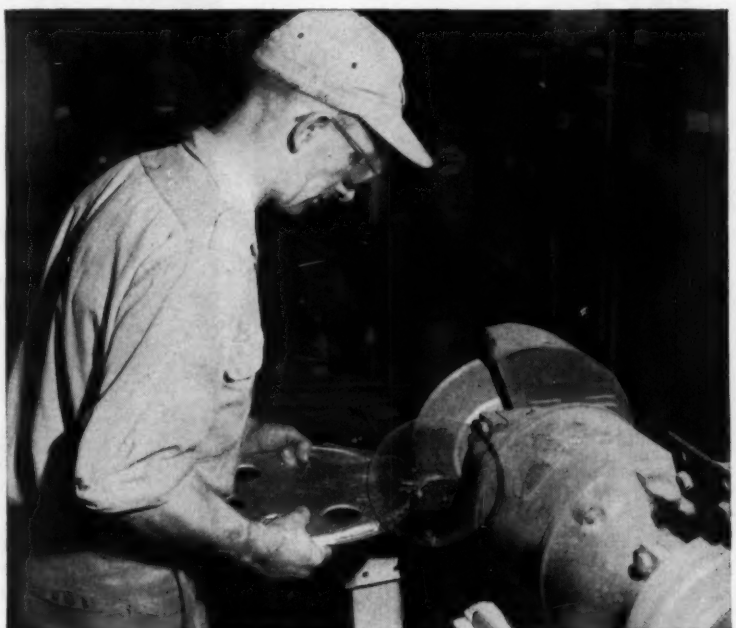
Norton diamond wheels, carbide grinding's recognized "Crown Jewels", are products of Norton's long leadership in diamond wheel development. Made in all required bond types, their accurate cutting action and extra long service life bring you top savings in every single-point and multi-tooth carbide grinding application. Also available are CRYSTOLON* wheels — green and gray — with the cost-cutting K Bond.

Your Norton Distributor

will gladly recommend the right Norton wheels for your tool room requirements. Or write direct. And remember: only Norton brings you such long experience in both grinding wheels and grinding machines — your assurance of the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

Offhand grinding a planer tool is a fast, cool operation with Norton G Bond wheels. ALUNDUM* abrasive permits top grinding speed without burning.



NORTON GENERAL PURPOSE WHEELS

For your ordinary bench or floor stand grinding, use these out-of-the-ordinary wheels. Available in abrasive-and-bond combinations for economical, trouble-free performance throughout the entire range of routine grinding jobs. Chances are that any tool wheel or general purpose wheel you require is carried in stock.

W-1660

NORTON

Making better products... to make your products better

and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

Available

from Winter distributors located in principal cities:

BALANCED Action

TAPS

Hand Taps
Machine Screw Taps
Chip Driver Taps
Nut Taps
Pipe Taps
Pulley Taps
Nib Taps
and various types of Taps for Special Applications

GAGES

A complete line of Plug and Ring Gages, Threaded and Plain.

DIES

Adjustable Round Split Dies
Hexagon Rethreading Dies
Solid Square Bolt Dies
Solid Square Pipe Thread Dies

PHONE YOUR WINTER DISTRIBUTOR

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit Cleveland • Chicago • Dallas • San Francisco Los Angeles

Division of National Twist Drill & Tool Co.

WINTER

WITH *Dependable* CUTTING EDGES . . .

National milling cutters and hobs, with their dependable cutting edges, are available from Factory and Distributor's stocks. They give you cutting edges for excellent production and long wear.

Milling cutters also available with carbide tips.

PHONE YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

Twist Drills • Reamers • Counterbores • Milling Cutters • End Mills • Hobs • Carbide Tipped and Special Tools

National

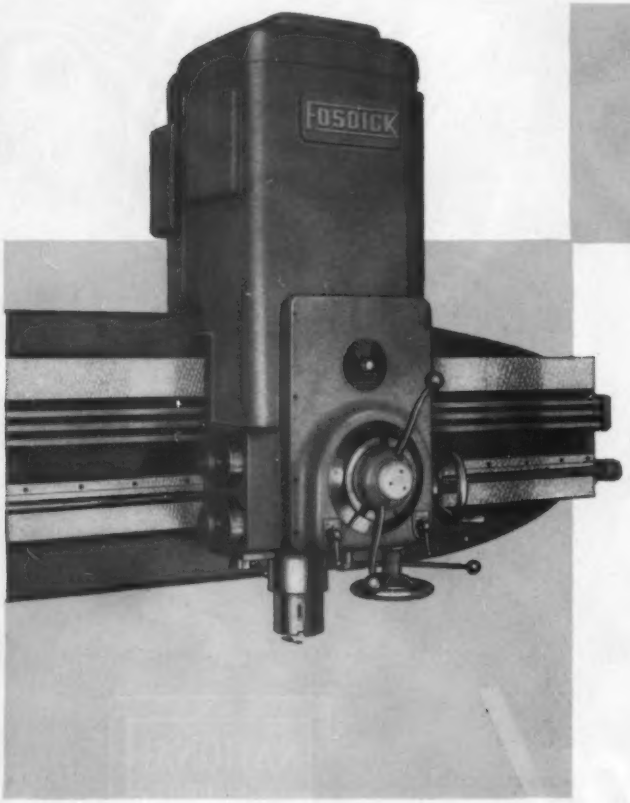
NATIONAL TWIST DRILL & TOOL ROCHESTER MICH. U.S.A.

With the NEW FOSMATIC Radial Drill

Pre-select Feeds and Speeds

All the new features needed by the modern machine shop have been designed into the new Fosmatic Radial Drill. Pre-selected feeds and speeds for a new degree of speed and operator convenience. Spindle speeds up to 3000 rpm to suit today's high-production requirements. Engineering refinements throughout to give you the rigidity you need for fast precision drilling.

Feeds and speeds are selected on dials at left side of the head, usually while waiting for a drilling operation to be completed. Shifting is accomplished by raising the spindle control lever slightly in its neutral position. Feed is engaged by pressing a button on either of the quick-return handles; feed is disengaged either by depth control or pressing one of the buttons. Other convenient controls at the head – Single lever elevates arm or traverses head (hydraulic variable rapid traverse). Hydraulic column clamp. Hydraulic arm clamp, safety-interlocked with elevating lever. Hand feed and traverse to the head. The tool ejector eliminates need for tang driver.

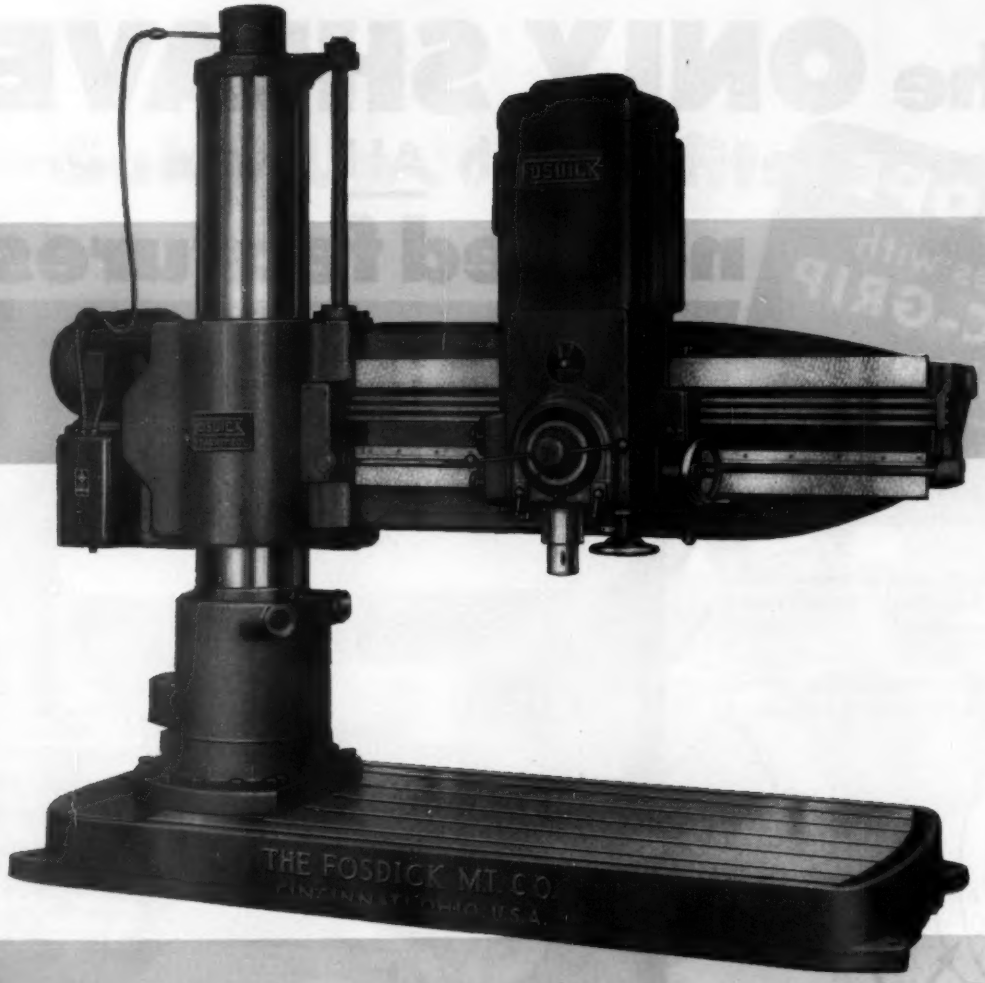


• • • • Drill with

Smooth running, high precision and extra rigidity make the new Fosmatic outstanding among Radial Drills. Case-hardened gears are ground on the finest equipment available. They run on ground splined shafts which are mounted in ball bearings. Lubrication is automatic.

Thirty-six spindle speeds with a maximum of 3000 rpm are available in a variety of ranges, each with a 127.5 to 1 ratio. The new boring-type spindle is of heavy section with bearings placed far apart for extreme rigidity; it can easily be used for boring, milling and the heaviest drilling. A new and unique counterbalance produces equal tension on the spindle whether it is extended or close to the head.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



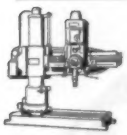
Speed, Ease and Precision

For more efficient tapping, reverse spindle speed is 40% faster than forward speed.

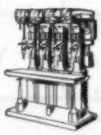
Our new arm is probably the strongest in the business. It has a double boxed section with very heavy walls; ways have been widened considerably. The head is mounted on roller bearings on hardened and ground ways with an additional roller support in back of the arm. Safety nut is hydraulic. Column is superfinished.

Eighteen feeds are available, including 5 tap leads, from .003" to .125". Feed engagement is through a powerful magnetic clutch which will never require adjustment. The feed dial is graduated to full spindle travel to eliminate resetting for deep holes. Electronic milling feeds are also offered—from ¾ to 15 ipm.

Standard sizes available with 4' to 8' arms, 13" to 19" columns.


Radial Drills

Jig Borers


Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

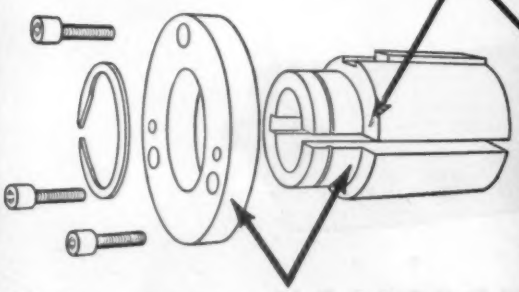
Get the ONLY SHEAVE with ALL these needed features

TEXROPE Sheaves with MAGIC-GRIP Bushings

Full-length bushing key for uniform torque transmission along entire bushing.

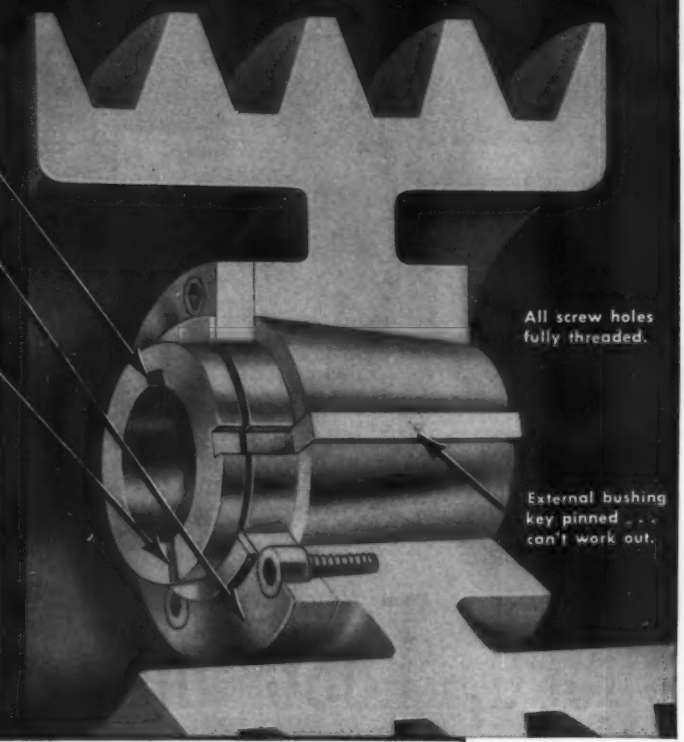
Floating collar allows cap screws to draw sheave on taper of bushing without binding — collar takes no torque.

Full-length split and uniform section provide uniform grip over entire contact surfaces.



No torque carried by screws as all torque is transmitted through keys.

Two-piece bushing (cast-iron sleeve and free-floating collar).



Here's Comparison of *Magic-Grip* Sheave and Other Sheaves

	Magic-Grip Sheave	Sheave A	Sheave B	Sheave C
Bushing fully split and uniform in section for full-length, full-circumference grip.	Yes	Yes	No	Yes
Torque carried by keys instead of threaded bolts.	Yes	No	No	No
All screws engage all threads fully.	Yes	Yes	Yes	No
Mounts in one piece.	Yes	No	Yes	Yes

See Your Allis-Chalmers District Office or Authorized Distributor

Texrope and *Magic-Grip* are Allis-Chalmers trademarks. A-4553

ALLIS-CHALMERS

MILWAUKEE 1, WISCONSIN

Sales Up . . . Profits Down?

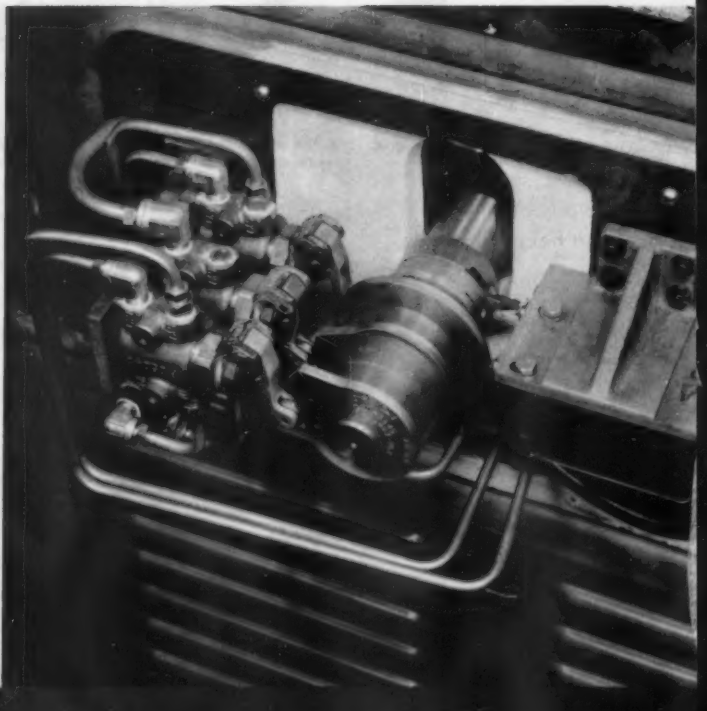
The Answer is New Methods on NEW BRITAIN

- AUTOMATIC CHUCKERS
- MULTIPLE SPINDLE BAR MACHINES
- SINGLE SPINDLE AUTOMATICS
- PRECISION BORING MACHINES
- LUCAS PRECISION HORIZONTALS
- NEW BRITAIN +GF+ COPY LATHES

See the following four pages for other New Britain *New's*.

The secret of precision boring is constant close control of the tool

Precision-ground cams assure accuracy of tool paths under all conditions on a New Britain Precision Boring Machine. Equally important is split-second control of cycle timing. This is accomplished by means of the program drum illustrated at the right. Cams and trip dogs accurately time all motions of the tool and the machine units. It is enclosed by a lift-off cover and is immediately accessible from the operator's side of the machine. These are important features of the New Britain approach to more profitable precision boring.



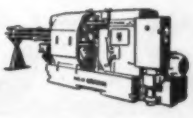
New Britain +GF+ Copying Lathe combines 2 operations in 1 pass

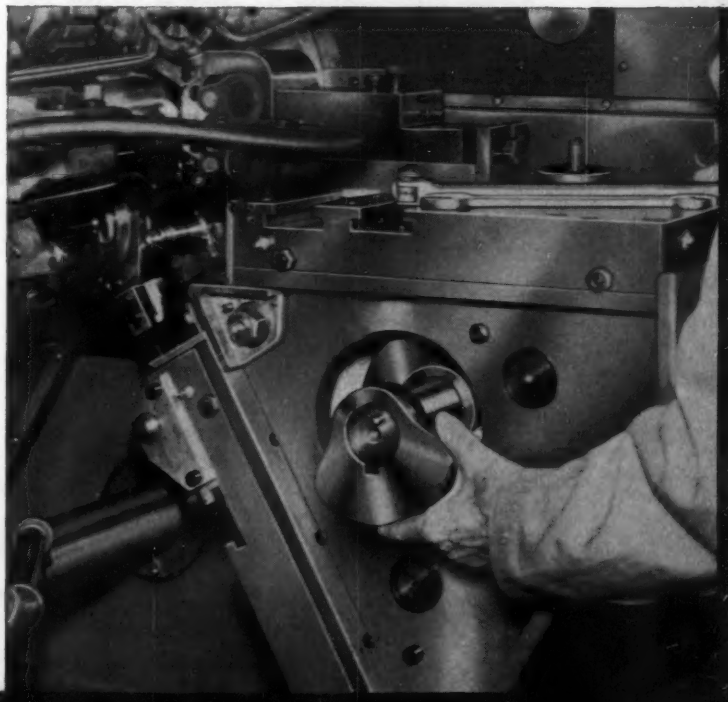
Yes, we taper turn the shaft end of this gear blank and copy turn the rest in the same operation — which keeps the cost of the piece down. This happens all the time on a New Britain **+GF+** copying lathe. You can spot other examples of it in the other pieces on the table.

The New Britain **+GF+** is a copy turning machine, not a lathe with an attachment. The copy slide is part of the carriage for taking heavy cuts at carbide speeds. Contoured work in small lots or on an automated basis, is accurately turned from a simple template on the front of the machine.

The secret of carbides on bar machines is elimination of slide deflection

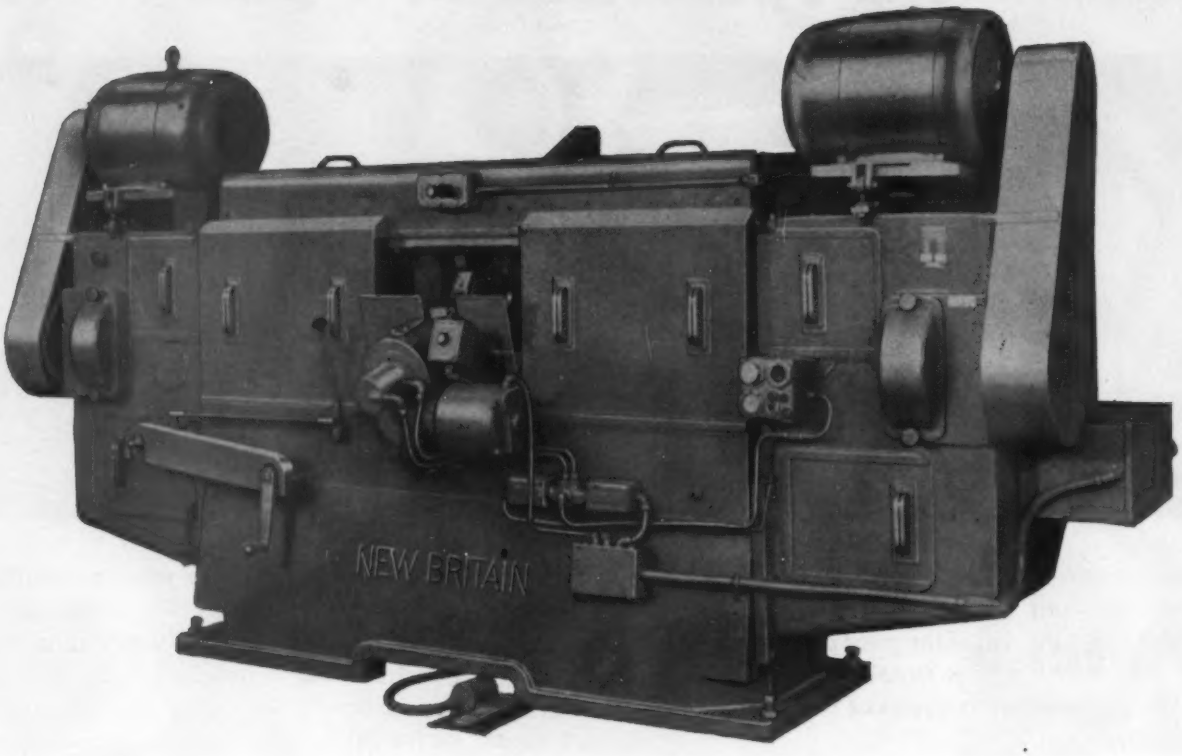
Carbides won't tolerate sloppy feeds. Positive slide actuation on a Model 601 New Britain Automatic results from mounting the cams directly behind the slides. A plus benefit is that cross slide feed changeovers can be made in minutes with these pick-off cams.

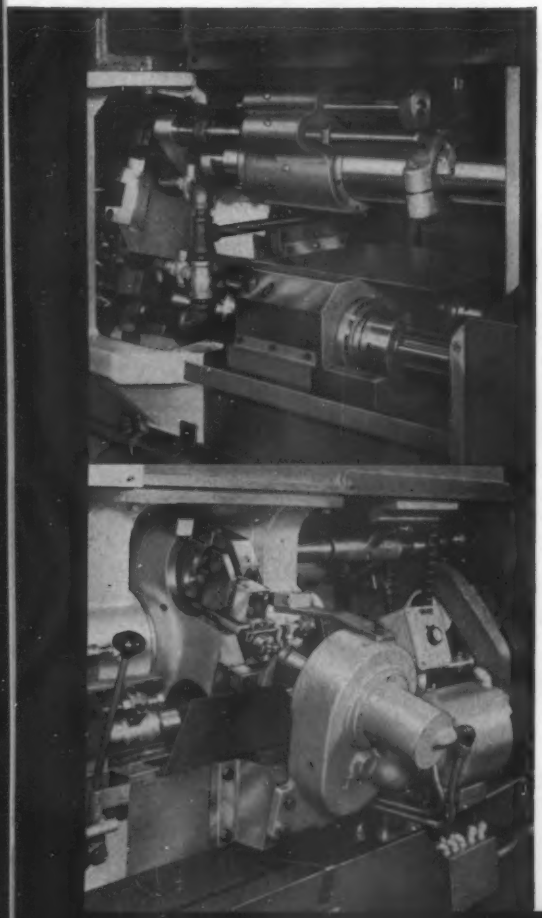




See the preceding two pages and the two following for other New Britain New's.

Six-spindle production in "Three-spindle" time





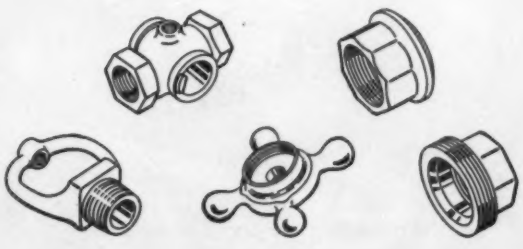
View of the rear side of the machine with the guards removed, showing the two lower spindles and the upper threading spindle.

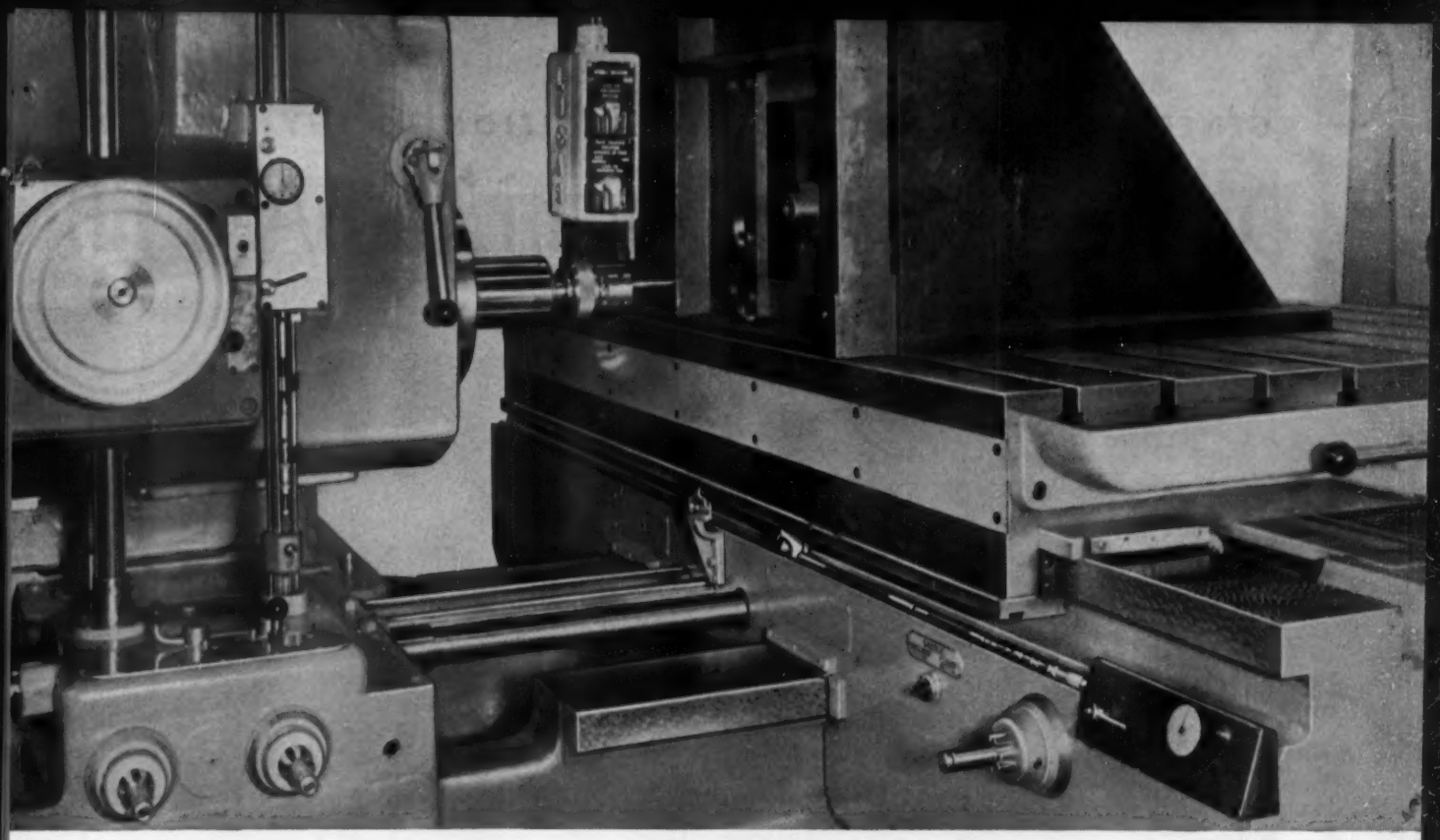
All controls are within easy reach of the operator. Chucking is accomplished during the operational cycle by manual or semi-automatic means.

This new double-end New Britain Model 365 chucker is specifically for parts which can be machined simultaneously at both ends in one chucking, or two pieces per cycle.

It furnishes the *high spindle speeds* required for work on brass and aluminum, plus *beef* for machining and threading steel, plus *accuracy* guaranteed by a new turret locking mechanism. Idle time is minimized by power chucking and rapid traverse of all slides.

If your requirements include accurate volume production of double-end work, the Model 365 New Britain chucker can be a highly efficient money-maker for you. For more information, please ask for the catalog on Model 365.

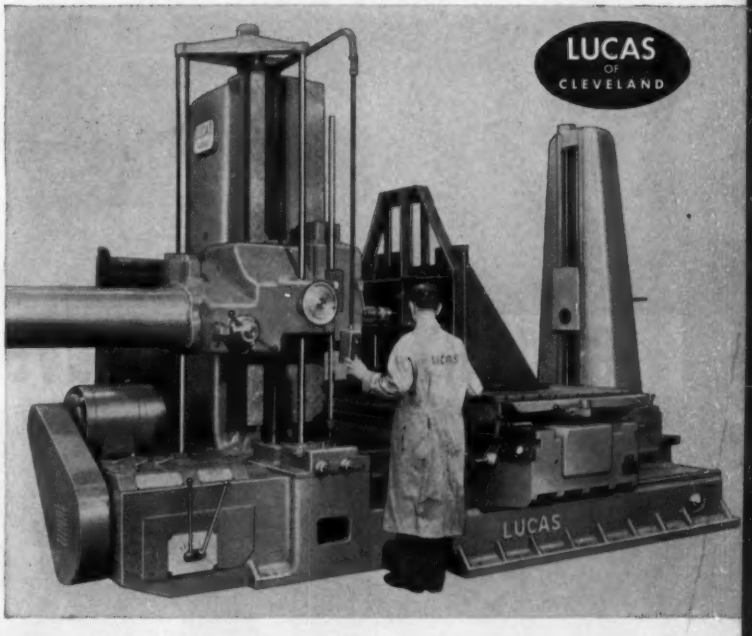




Automatic Power Positioning is a money-maker on boring machine jobs

The entire operation of setting the head and table is done through power feeds at rapid traverse speed. The operator simply inserts the proper measuring rods and starts the positioning cycle. It takes an absolute minimum of time and reduces the chance of error in locating bore centers.

Lucas pioneered and specializes exclusively in building the horizontal boring machine. The full possibilities of this multi-purpose machine are enjoyed by Lucas owners, because of the many important Lucas features and improvements — including Automatic Power Positioning, new simplified pendant control and many more. May we send you the latest descriptive Lucas catalog. Address Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.



• AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
• LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES • NEW BRITAIN +BF+ COPYING LATHES

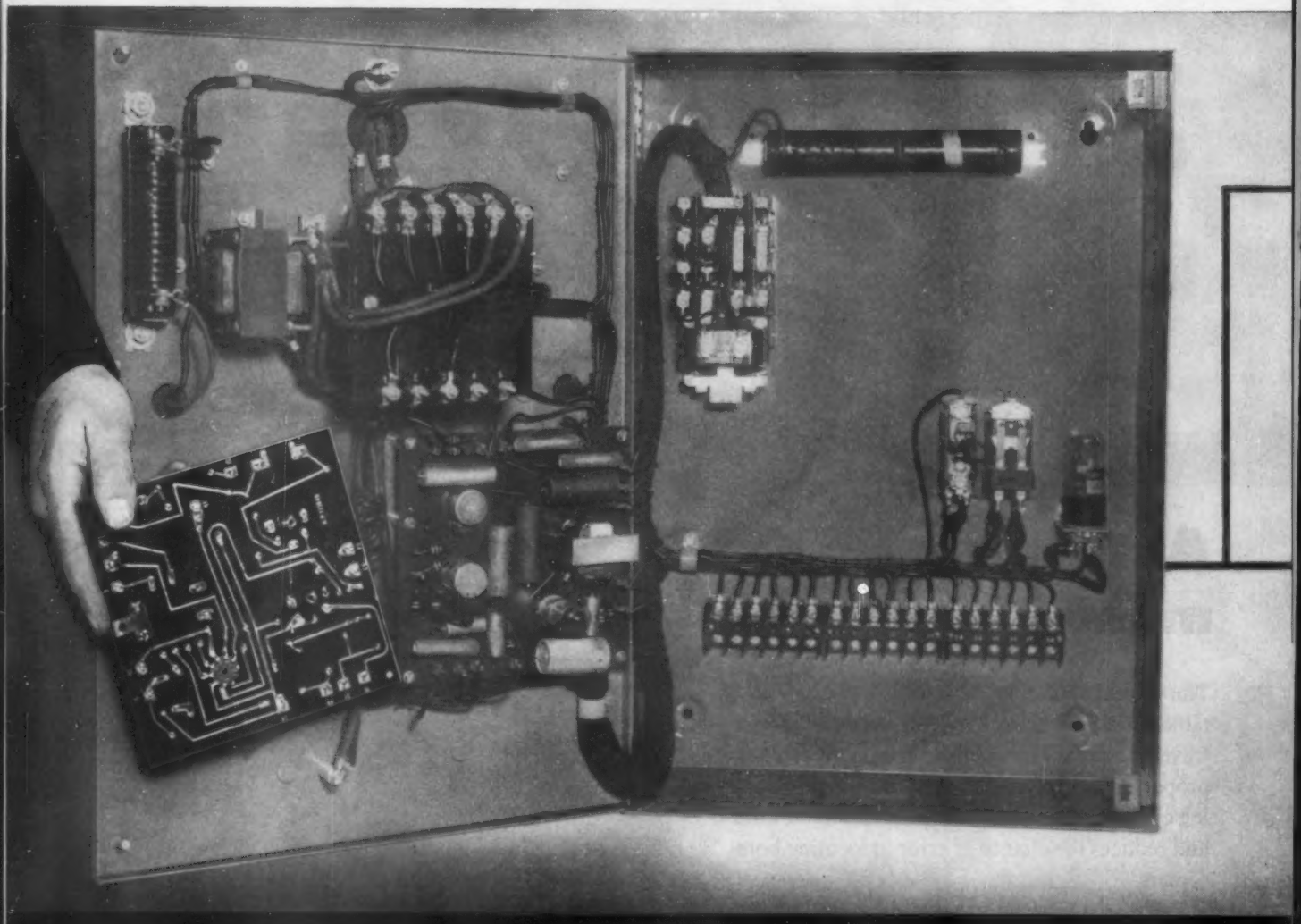
The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

See the preceding four pages for other New Britain *New's*.

GENERAL ELECTRIC ANNOUNCES ADDITION TO THY-MO-TROL*

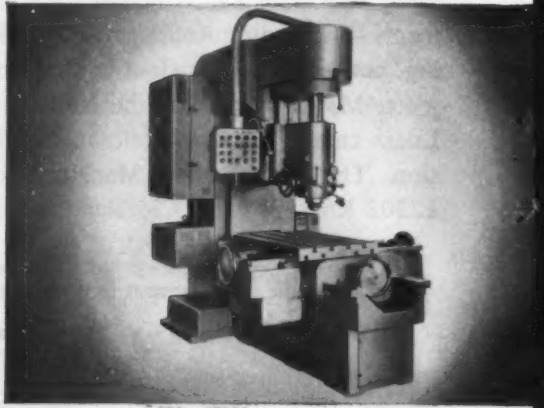
NEW Low-priced 3/4-3 HP



G-E THY-MO-TROL DRIVES ARE IDEALLY SUITED

Electronic Induction Heater. Thy-mo-trol Drive moves the carriage to exact pre-set conditions to assure uniform heat treatment.

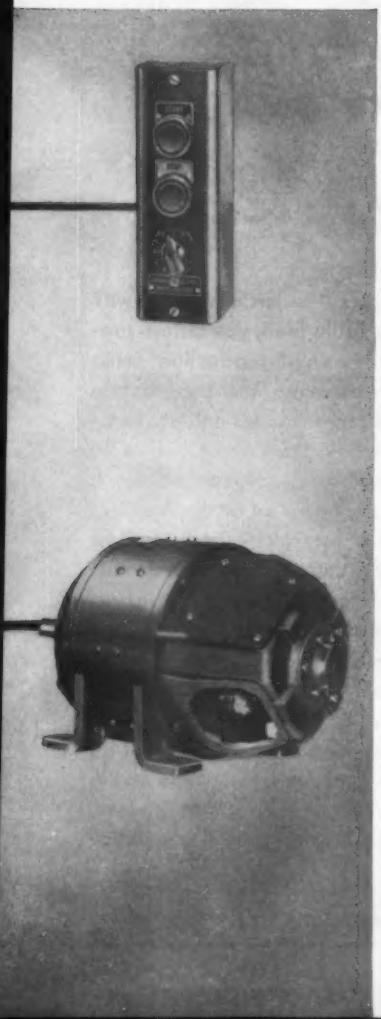
Surface Grinder. All motions on this grinding machine are controlled by General Electric's Thy-mo-trol Drive: spindle, table and cross-feed operations.



Milling Machine. Thy-mo-trol Drives automatically step up production on this milling machine by giving correct speeds for spindle, table and spindle head drive requirements.

DRIVE LINE . . .

Thy-Mo-Trol Drive with Printed Circuitry



NOW! FOR MACHINE TOOL APPLICATIONS —A RELIABLE, SIMPLIFIED, ADJUSTABLE SPEED DRIVE

These new, simplified General Purpose, 3/4-3 HP Thy-mo-trol Drives have been developed for industrial applications demanding wide speed range and close speed regulation. Embodying all the smooth adjustable speed characteristics of DC drives, the two models offer greater performance, reliable operation and wide speed range selection for many industrial applications.

A PRICE REDUCTION, due largely to G.E.'s industrial application of printed circuitry has been made. The entire control system has been simplified, giving the user substantial reductions in over-all weight, size, circuit complexity, amount of wiring, maintenance costs and installation costs.

OPERATING DIRECTLY FROM AC POWER, the new Thy-mo-trol Drives can increase machine production on most applications because they • Give the correct speed for the required operation • Reduce operating spoilage and rejects because of high accuracy performance and • Increase machine versatility because of the wide speed range and close speed regulation features offered.

THE COMPLETE THY-MO-TROL DRIVE LINE COVERS ratings from 1/40 to 30 HP and beyond. Speed ranges of 5:1, 20:1, 50:1, and 100:1 are typical. Speed regulation of $\frac{1}{2}$ of 1% is possible over the entire speed range.

SIMPLIFIED FRACTIONAL HORSEPOWER THY-MO-TROL DRIVES are supplied as half-wave or full-wave units, allowing a wide selection of performance standards to meet each particular industrial application.

HIGH PERFORMANCE INTEGRAL HP THY-MO-TROL DRIVES, 3/4-30 HP, full-wave offer these superior performance features: greater flexibility, rugged industrial-type construction, easy maintenance, wide speed range, adjustable current limit, flat speed regulation and optional features such as: jogging, quick slowdown, reversing, dynamic braking, tachometer feedback and position synchronization all add up to qualify these drives for many machine tool and industrial applications.

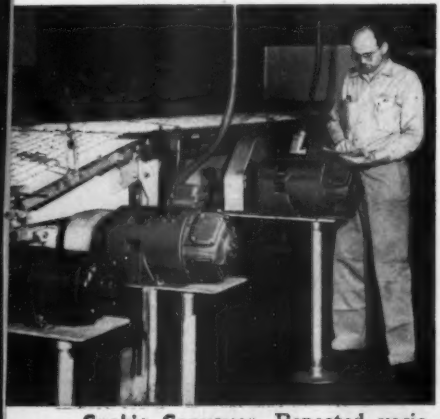
FOR MORE INFORMATION on General Electric's Thy-mo-trol electronic adjustable speed drives, contact your nearest G-E Apparatus Sales Office or write for Bulletins GEA-6234, GEA-4089, GEA-5179, GEA-5827 and GEA-5337—General Electric Company, Schenectady, N. Y. 791-2

Progress Is Our Most Important Product

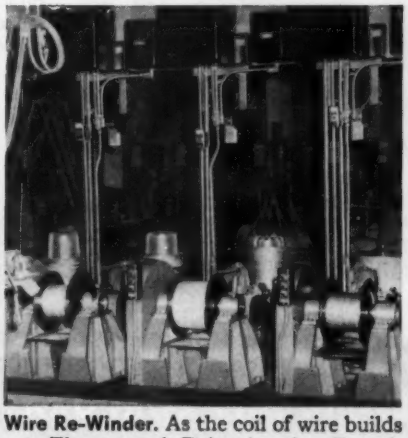
GENERAL ELECTRIC

* *Reg. Trade-mark of General Electric Company.*

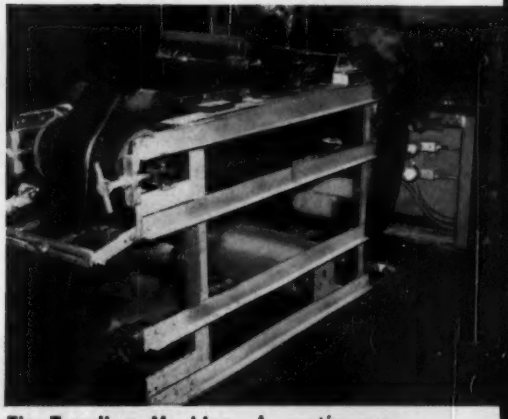
TO THESE TYPICAL INDUSTRIAL APPLICATIONS



Cookie Conveyor. Repeated variations in speed—necessary to meet baking requirements—are easily handled by Thy-mo-trol Drive.



Wire Re-Winder. As the coil of wire builds up, Thy-mo-trol Drive continually adjusts speed of reel to maintain constant winding at maximum speed.



Tire-Treading Machine. A continuous strip of tire-tread passes from extruder (in background) to conveyor. Thy-mo-trol Drive synchronizes the operation.

pneumatic feed—for speed ...on the SEMI-AUTOMATIC

Nichols Miller

In selecting the Nichols Miller with pneumatic table feed, you obtain precision and a high-production semi-automatic machine. The push-button controlled power feed is entirely automatic — leaves the operator free to merely load and unload the work. Often he may run two or three millers with ease. The air cylinder works against the cutter *and* the hydraulic cylinder — completely eliminating chatter and table jump. The unit provides rapid advance from loading position to the cutter, infinitely variable cutting feed, and rapid return to loading position. Also available with power vertical feed to spindle head. If you want high production to "tenths", investigate the Nichols Semi-automatic!

"the miller that uses its head!"

CONDENSED SPECIFICATIONS

Table Working Surface	6¼" x 21"
Longitudinal Travel	
Pneumatic	9"
Cutting Stroke	5⅜"
Hand Screw (Optional)	10"
Transverse Travel	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

The Semi-automatic set up with air vise on a production job. Vise operated automatically by table movement.

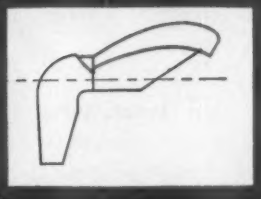
Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

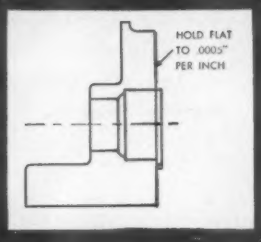
NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-F MAMARONECK AVE.
WHITE PLAINS, N. Y.

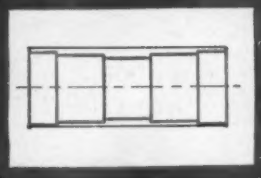
Setup and Tooling Costs ON THE HOUSE



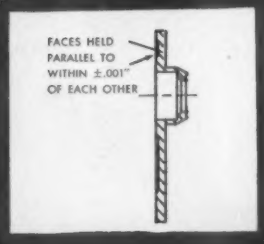
Part—[illegible] Operation—turn elliptical contour of 220° 15° angle on face and short O.D. on opposite end. Comment—could not be farmed economically prior to use of Air-Gage Tracer.



Part—[illegible] Material—aluminum casting. Operations—turn, face and bore. Total machine time—3 minutes.



Part—[illegible] Material—seamless steel tubing. Operations—face and bore both ends. Floor to floor time per piece—1¾ minutes.



Part—housing cover. Material—aluminum forging. Operations—turn, face both sides and bore. Floor to floor time per piece—4¾ minutes. Previous production—7 pieces per hour.

How One Leading Contract Shop Affords It

What's the secret of absorbing these costs—with competitive bidding and profit margins as they are in the contract shop field today?

"Simple," says C. C. Gregson, President, Illinois Gage and Manufacturing Company of Franklin Park, Ill., leading supplier of highly specialized machining of aluminum and magnesium castings. "We are able to produce a better job faster and hold close tolerances more economically than shops *provided with conventional equipment.* Setup and tooling is so minor that in most instances the customer is not even charged for it."

Note that phrase "conventional equipment"—it's the pay-off! The one 16" and the two 13" Monarch lathes you see pictured below are all Monarch Air-Gage Tracer equipped. So is the 10" Monarch that isn't in the picture. There's your difference!

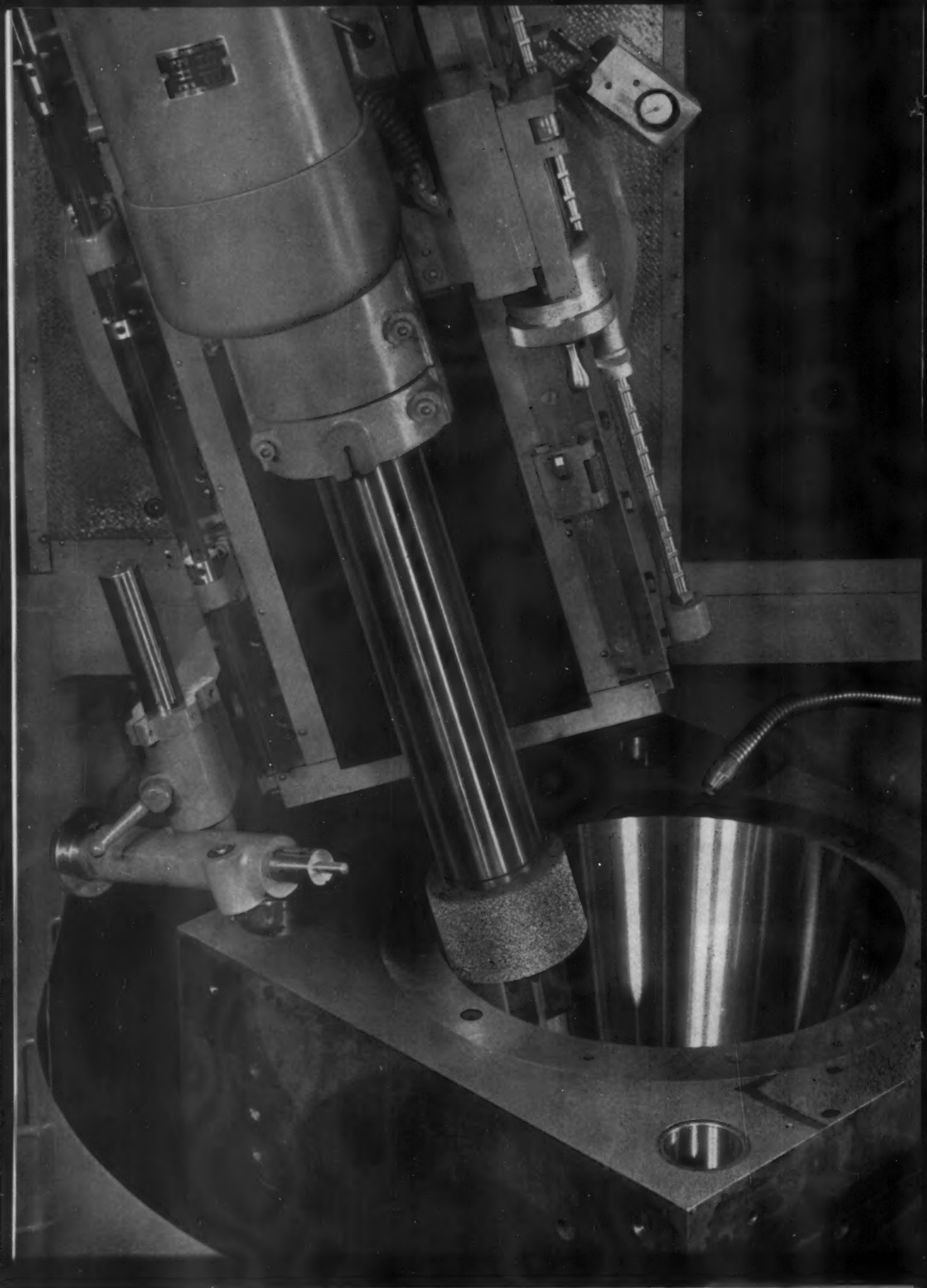
To quote again, "we have found they speed up production anywhere from 10% to 90%." Air-Gage Tracers in your plant would likely enable you to realize similar savings. Why not investigate? . . . ***The Monarch Machine Tool Co., Sidney, Ohio.***

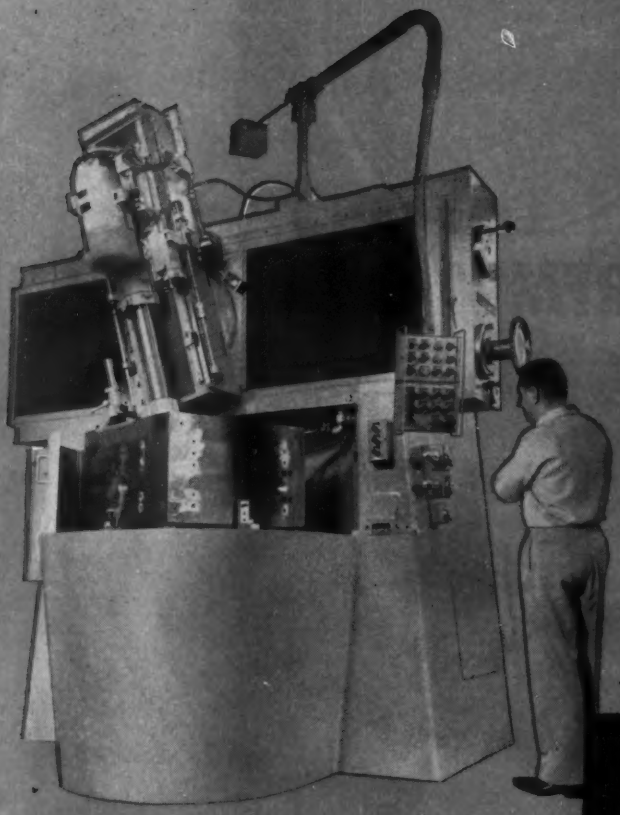
Monarch

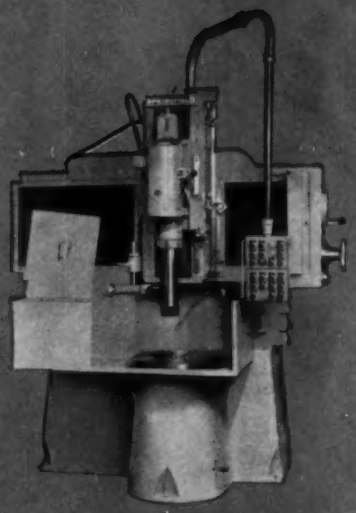
ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH







one setup: nine jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

Vertical Universal Grinders: swings 18″, 24″ and 42″.

Lathes: Engine and tool room, contouring and reproducing—swings 14″ to 32″.

The Springfield Machine Tool Company

Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

Ross

FOUR WAY REMOTE CONTROLLED MASTER VALVE

- **May Be Removed without Disturbing Piping**
- **For Air and Low Pressure Fluid Service**
- **Working Parts Interchangeable with Ross 700 Series Base Mounted Valves**
- **Poppet Type for Extra Economy**

Write for Engineering Data No. 5411

{ Ross EnginAIRing — Leads in Air Controls }

Ross OPERATING VALVE CONTROL COMPANY

120 E. GOLDEN GATE AVENUE • DETROIT 3 • MICHIGAN

Tips from Taft-Peirce

on how to...

Grind to .0001″

Hard to believe but true. This Taft-Peirce No. 1 Surface Grinder, with verniers, produces surfaces of an accuracy, flatness, and finish formerly considered difficult or impossible to achieve. Experienced operators frequently can grind to .00005″, with surfaces so smooth, in many cases, they seal without lapping.

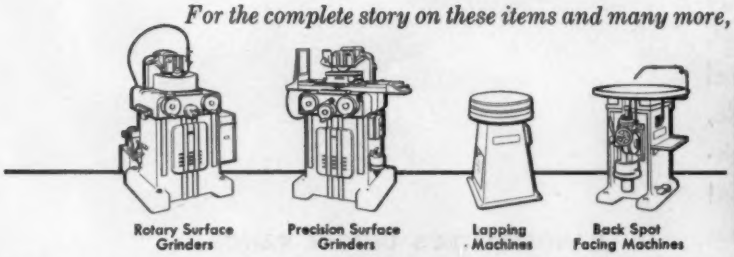
Lower Lapping Costs

A T-P 24″ Rotary Lapping Machine offers a fast, accurate way to obtain superfine finishes and true contact surfaces. Low in original cost, economical to operate, it has the speed and capacity for rapid processing in small lot manufacture or tool room work. Available with plain plate for cylindrical work, grooved plate for flat work.

Reduce Grinding Time

Developed for our own shop, T-P 6″ Rotary Grinders make fussy precision work easier and faster than ever before. Tilting Wheelhead tips 30 degrees below center . . . locks accurately in any position. Superpower magnetic chuck turns through 15 degree angle. Vernier feed permits .0001″ vertical settings.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

dynamic

NEW

advance

in

milling

versatility...

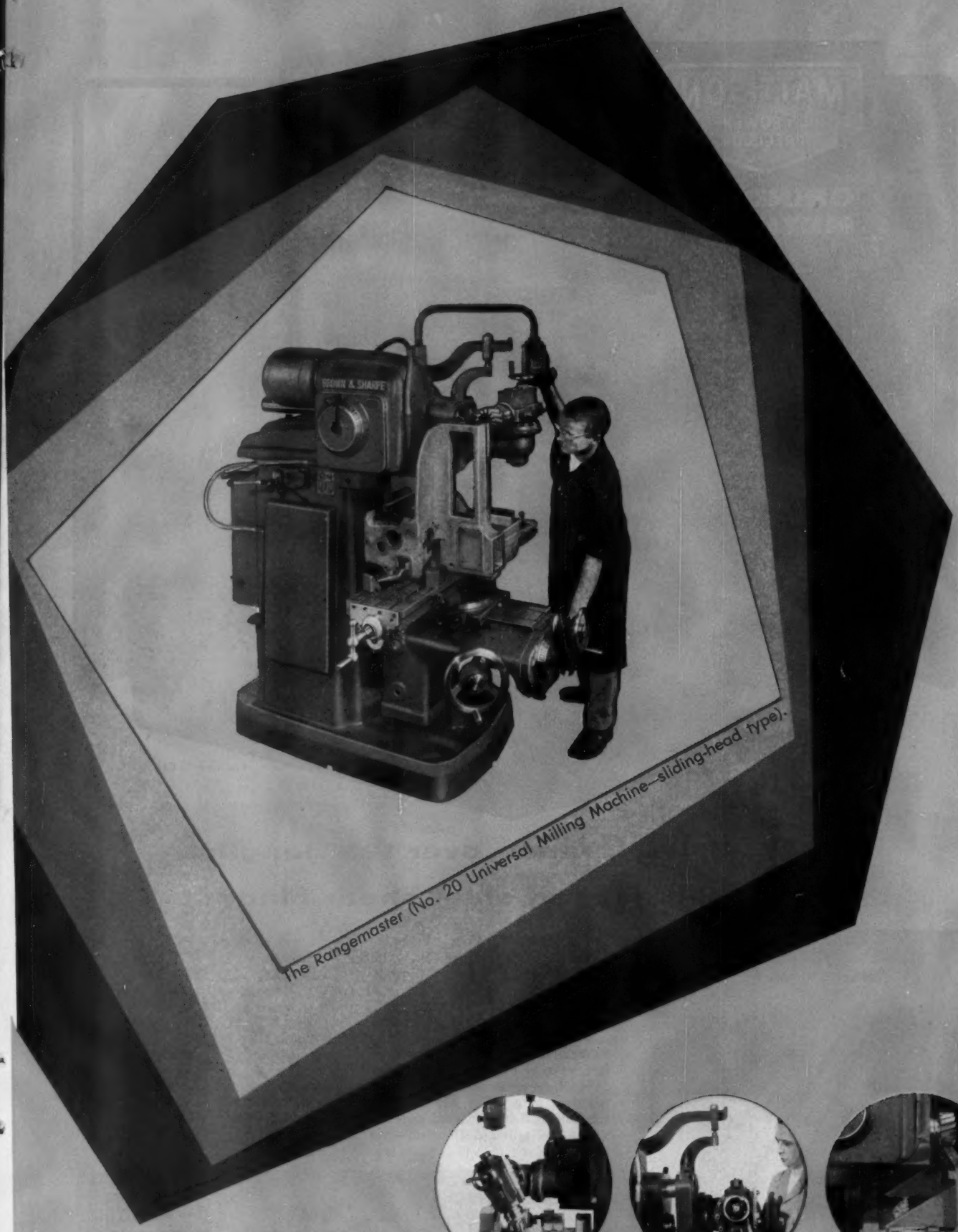
the

RANGEMASTER

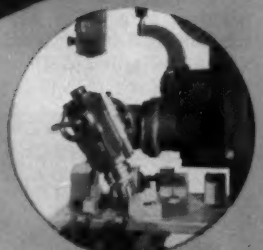
Now the new Brown & Sharpe *Rangemaster* provides work-range and milling flexibility unmatched by any other single machine! Saves tremendously on set-ups — especially for multi-surface milling jobs. Permits fast, easy changes from horizontal to vertical and angular milling. Both spindles utilize full power on all work; vertical spindle has 18 speed changes from 80 to 3060 rpm. Exclusive features: Quill feed and universal head movement give 360° range in two planes without extra attachment. Both spindles on same vertical centerline. Massive ways, 22" wide, for sliding head. Sustained high-accuracy milling in any work position! Available as universal or plain milling machine. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

RANGEMASTER'S UNIQUE RANGE

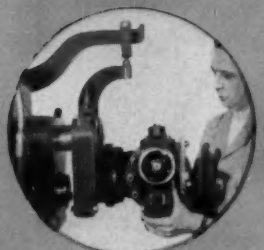
28" table travel • 12" transverse feed
22⅞" sliding head movement • 20¼" vertical feed
3½" hand movement of quill in universal head



The Rangemaster (No. 20 Universal Milling Machine—sliding-head type).



Horizontal, vertical, or angular milling quickly available with full 3 h.p. at spindle.



Universal head permanently mounted on crane—swings completely out of way when not in use. Both spindles always at ideal height for fast set-up and easy operation.

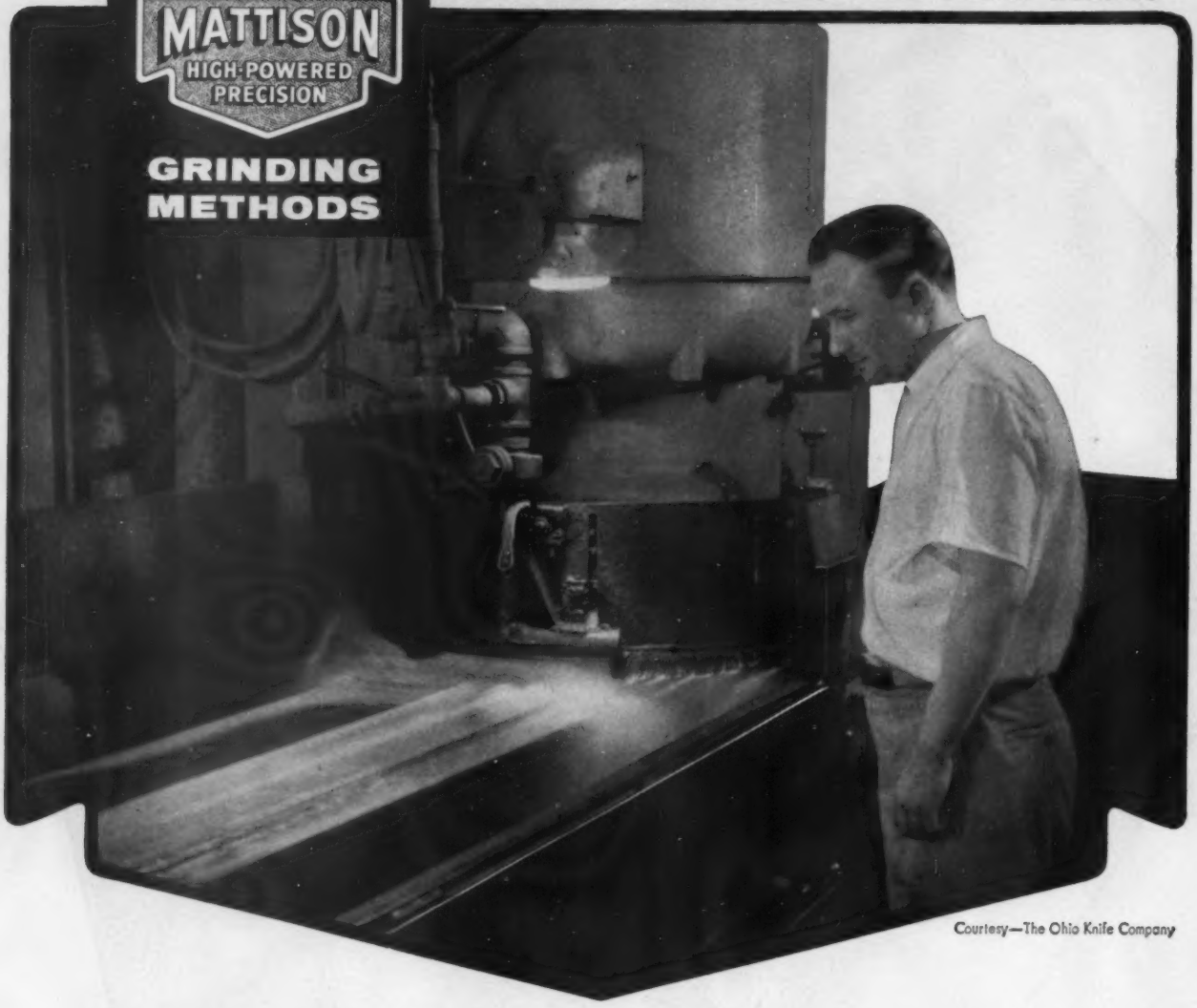
Full use of table travel plus exceptional sliding head range permits milling of many multi-surface jobs with only one work set-up.

Brown & Sharpe

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS

CASE HISTORY NO. 5—H-S STEEL SHEAR BLADES



Courtesy—The Ohio Knife Company

Holds .001" tolerance over 123" length... facing high-speed steel shear blades!

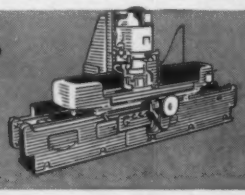
Operation—face two sides and race one edge of No. 4 welded high-speed steel shear blades (123" x 2⅞"). Accuracy is within .001".

Two sides of shear blades are ground on the Mattison No. 400SS Vertical Spindle Surface Grinder, holding a tolerance of .001" over entire length. Such accuracy is easily achieved on the "400SS" because the hydraulic table, heavily ribbed in *two* directions, never overhangs the bed, even at extreme end positions.

Stock removal and flatness are no problem, either. For, Mattison's extra long and heavy head slide prevents twist and deflection—high horsepower permits maximum stock removal with only minimum wheel clearance. With a 28" dia. wheel and approximately 7½" over-all work width, the grinder easily generates an accurate, flat surface . . . with stock removal conditions that promote high production, maintain a free cutting action, and produce fine finish.

Let Mattison demonstrate what *high-powered* precision surface grinding and today's improved wheel bonds can do on your job. Write for Bulletin No. 847.

HIGH-POWERED
PRECISION
SURFACE
GRINDERS

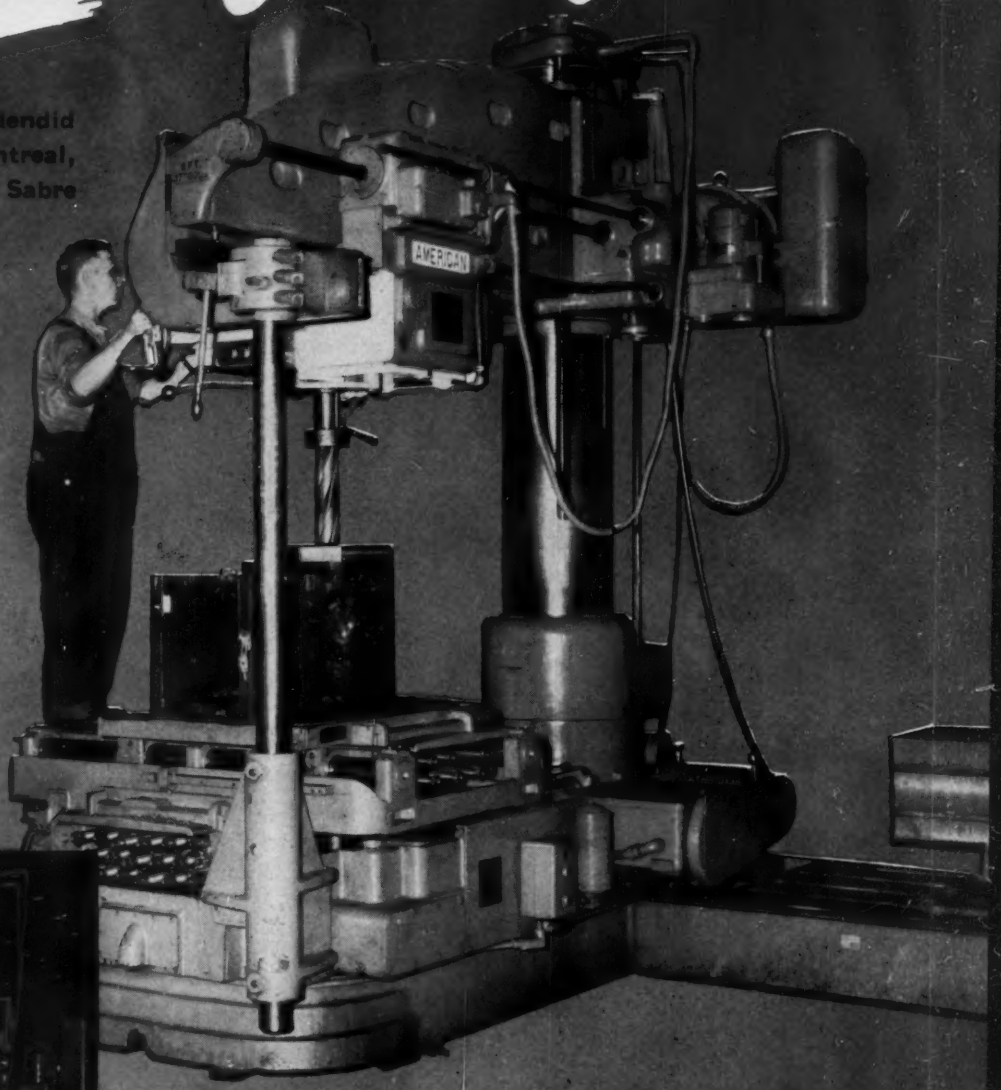


MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.



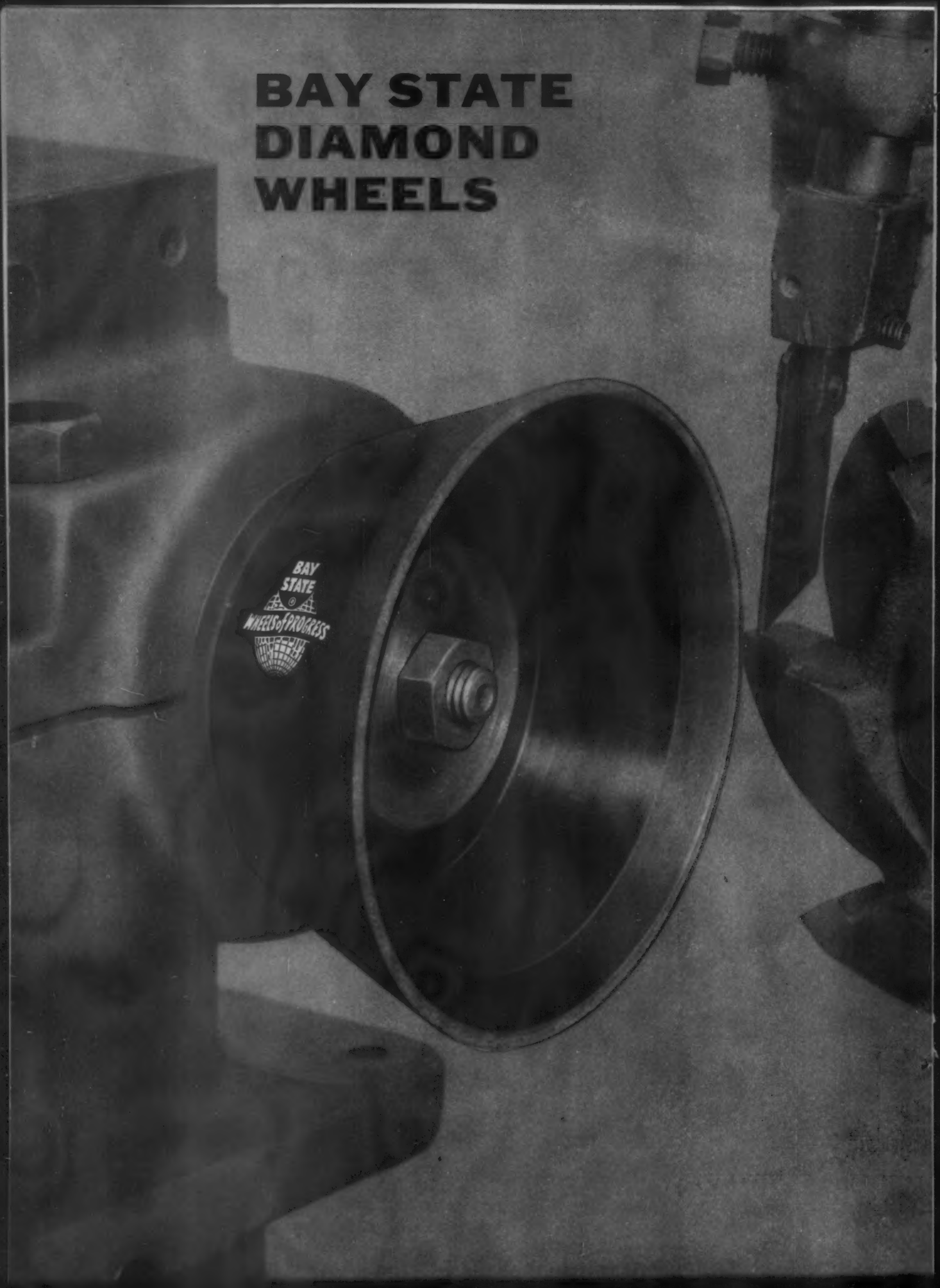
This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS


BAY STATE
DIAMOND
WHEELS
BAY
STATE
WHEELS of PROGRESS

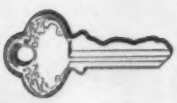
for ALL YOUR TOOL GRINDING NEEDS

BAY STATE's complete line of diamond wheels offers the *correct* shape and specification to meet your exacting tool grinding requirements.

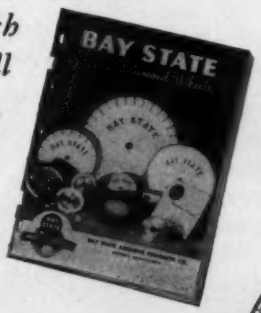
For example, BAY STATE'S new "BA" resinoid bond in the flaring cup wheel illustrated provides:

- Excellent corner holding qualities for grinding accuracy and maximum wheel life.
- Both dry and wet grinding from the same wheel.
- Ability to grind both carbide and steel where steel cannot be backed-off.
- High heat resistance to maintain bond strength, sharp, cool cutting, and top wheel efficiency.

This is one more illustration of better grinding engineered by BAY STATE in its outstanding "Wheels of Progress" program.



Call on your local BAY STATE DISTRIBUTOR, *he's a key man on all grinding problems. Ask him for the latest Diamond Wheel Handbook which includes net prices in all bonds: Vitrified, Metal, Resinoid.*



BAY STATE ABRASIVE PRODUCTS CO.,
Westboro, Mass., U.S.A.

Branch Offices and Warehouses — Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.
Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

Manufacturers of all types of Quality Abrasive Products

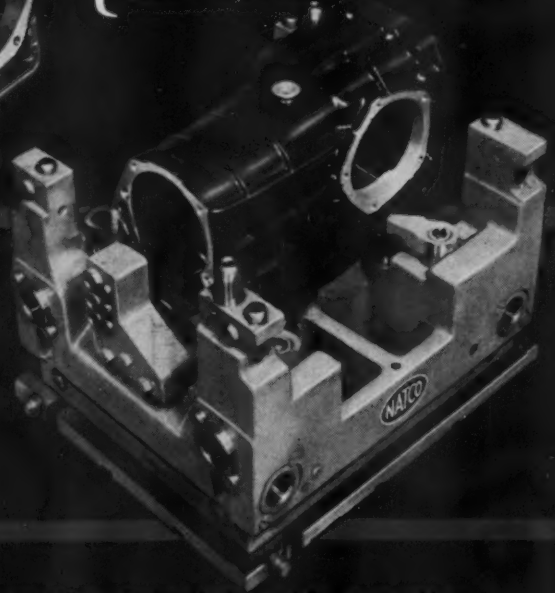
BAY STATE ®
WHEELS of PROGRESS

MORE TRANSMISSION CASES AT LESS COST.....

55 PARTS per HOUR

201 OPERATIONS ON EACH PART

DRILLED, BORED, REAMED, TAPPED, SPOTFACED, CROSS-FACED, MILLED, CHAMFERED and INSPECTED



Parts are loaded into individual holding units which are conveyed through the machine automatically. After machining is completed, chips are removed and the holding units pass through a washer and are returned to the first station.

for answers to your Drilling, Boring, Facing and Tapping problems

Call a Natco Field Engineer

CHICAGO, *Room 203, 6429 W. North Ave., Oak Park*
DETROIT, *10138 W. McNichols Rd.*
BUFFALO, *1807 Elmwood Ave.*
NEW YORK, *35 Beechwood Ave., Mount Vernon*

..... WITH A NEW NATCO HOLEWAY

BECOME OR REMAIN COMPETITIVE THROUGH MODERNIZATION

... Competitize with NATCO production!

NATIONAL AUTOMATIC TOOL COMPANY, INC.

RICHMOND, INDIANA

NATCO

"Operations Kingsbury" in custom-built indexing machines

MALLEABLE IRON DIFFERENTIAL CARRIER

240 pieces per hour gross. 24 operations. 8¢ per piece.

Stas. 1-H, 2-H, 3-H: Drill .421 holes.

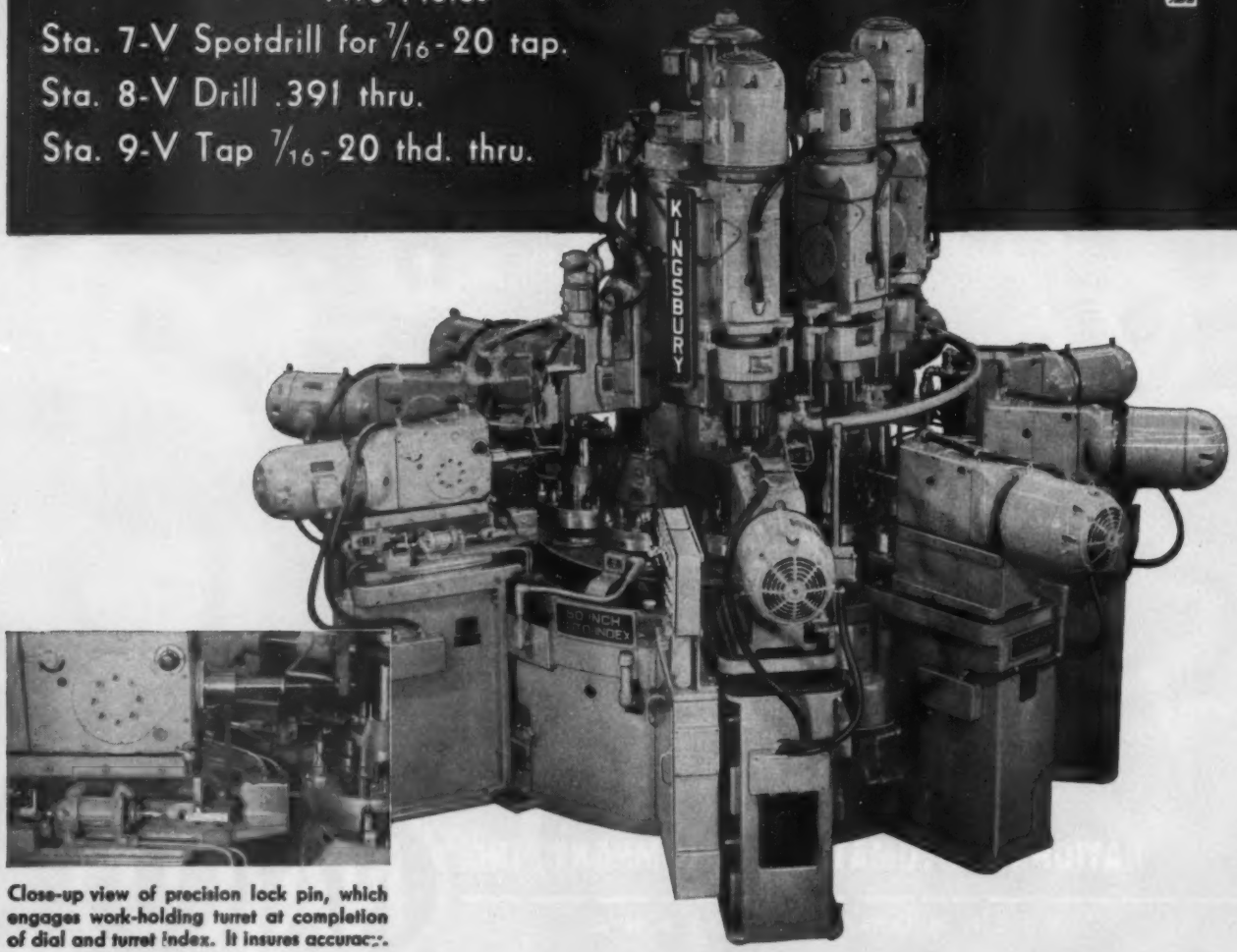
Stas. 4-H, 5-H, 6-H: Spot face $1\frac{3}{16}$ dia.
C'sink for $\frac{1}{2}$-13 tap.

Stas. 7-H, 8-H, 9-H: Tap $\frac{1}{2}$-13 thd. thru.

Sta. 7-V Spotdrill for $\frac{7}{16}$-20 tap.

Sta. 8-V Drill .391 thru.

Sta. 9-V Tap $\frac{7}{16}$-20 thd. thru.



Close-up view of precision lock pin, which engages work-holding turret at completion of dial and turret index. It insures accuracy.

can mean uniform parts at low cost for you

The Malleable Iron Differential Carrier (at left) calls for eight tapped holes. The five vertical holes require three operations, and present no special problem. But . . . the three horizontal holes also require three operations each — and these holes are spaced 120° apart.

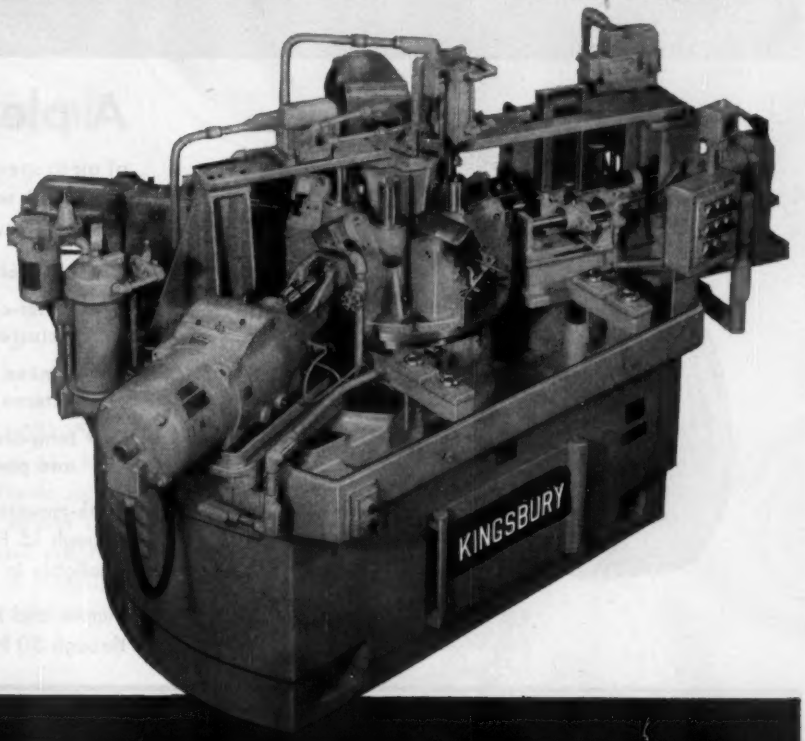
A central column machine is used. It has a 60-inch index table with ten stations (one for loading and unloading). Each of the work-holding fixtures is mounted on a rotating turret which turns 120° as the table indexes. For accuracy, the turret is locked in position as shown in the detail photograph. Work is clamped onto the fixture at each work station.

The Cast Iron Manifold Heat Control Assembly (below) calls for precision machining *and an assembly operation*. This work is *all* accomplished in one production cycle on machine illustrated. The table indexes through five stations (one for loading and unloading). Operations are performed by four horizontal units. At Stations 1, 2 and 3 the hole is drilled, countersunk and reamed. At Station 4 the pins (fed into a chute and released by an escape mechanism) are pressed into the prepared hole by a specially-designed hydraulic ram.

Machines *designed and built* by Kingsbury use work-tested Kingsbury units such as heads, index mechanisms, cutting tool guides, synchronized controls, bases, etc. *But the work-holding fixtures are special — designed for each part.* They have to be, for unless the part can be located correctly and held firmly, required *accuracy* cannot be obtained. And unless the fixtures can be loaded and unloaded quickly and easily, *production* will suffer.

It's a job that requires specialized skills and experience. *We have both.*

Kingsbury Machine Tool Corp.
110 Laurel Street
Keene, New Hampshire

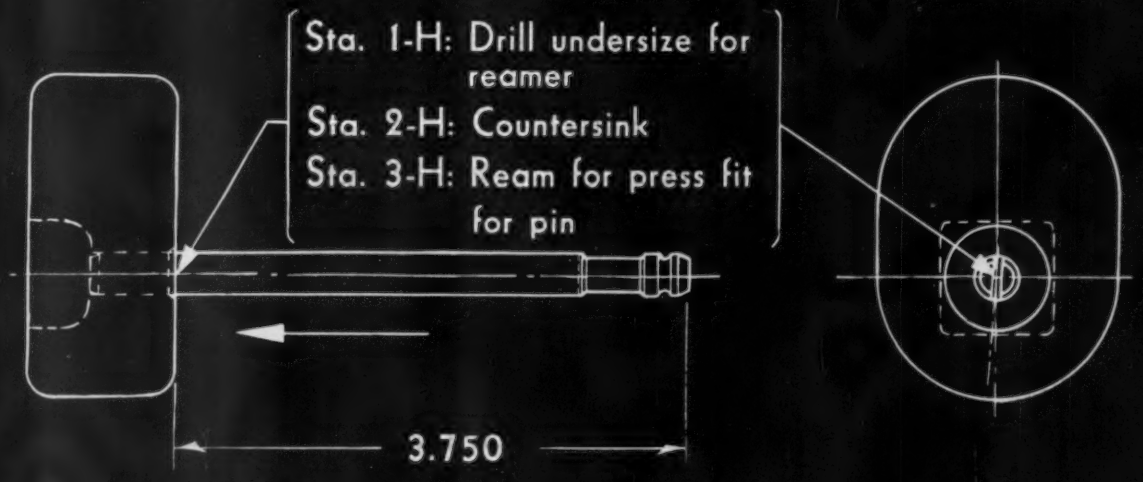


KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

CAST IRON MANIFOLD HEAT CONTROL ASSEMBLY

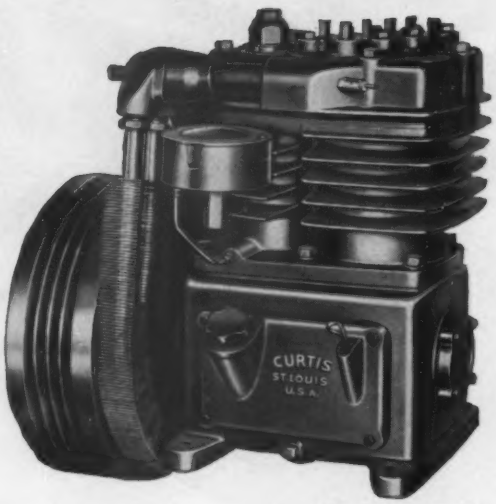
300 pieces per hour gross. Four operations. '2 2/10 ¢ per part.



Sta. 4-H. Press pin in place with hydraulic ram assembly.

Cut your costs with *Curtis*

AIR COMPRESSORS
AIR HOISTS
AIR CYLINDERS



A plentiful supply

of air to speed production throughout your plant is assured with powerful, precision-built *Curtis* Air Compressors.

- **air-cooled, two stage—¼ to 20 H.P. inclusive**
- **water-cooled, single stage—20 to 50 H.P. inclusive**
- **Timken tapered main bearings permit easy external adjustment**
- **long-life pressure-lubricated connecting rod and piston pin bearings**

Tank-mounted compressors in sizes from ¼ through 15 H.P. inclusive (1 to 78 cu. ft.)—also available in base-mounted type.

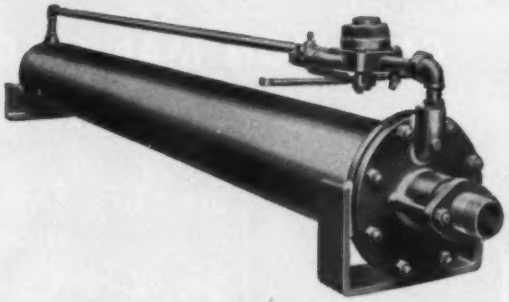
Simple and base-mounted compressors from ¼ through 50 H.P. inclusive (1 to 300 cu. ft.).

LIFT, LOWER, PUSH or PULL

easily, economically and safely with *Curtis* Air Hoists and Cylinders . . . capacities up to 10 tons.

- **lower initial cost**
- **lower maintenance costs**
- **smooth operation and precision control**
- **self-closing, rotary disc self-grinding valves**

PENDANT AIR HOISTS . . . ideal for any lifting or lowering operation.



BRACKETED AIR CYLINDERS . . . can be mounted horizontally or vertically for lifting, lowering, pushing or pulling.

FOR COMPLETE INFORMATION ON THIS CURTIS COST-SAVING EQUIPMENT . . . WRITE TODAY!

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1924 KIENLEN AVENUE • ST. LOUIS 20, MISSOURI

CM-837

OTHER CURTIS PRODUCTS: Automotive Lifts and High Pressure Car Washers; Commercial and Home Air Conditioning

Within the Span of a Man's Hand

The power to transmit the commands of the operator *to the machine* . . . . . .

By means of the movable PENDANT CONTROL the start and stop of the spindle; selection of speeds, feeds and directional movements of all heads in feed or traverse are quickly and easily accomplished. Interlocks and a stopall stick provide safety for both operator and machine.

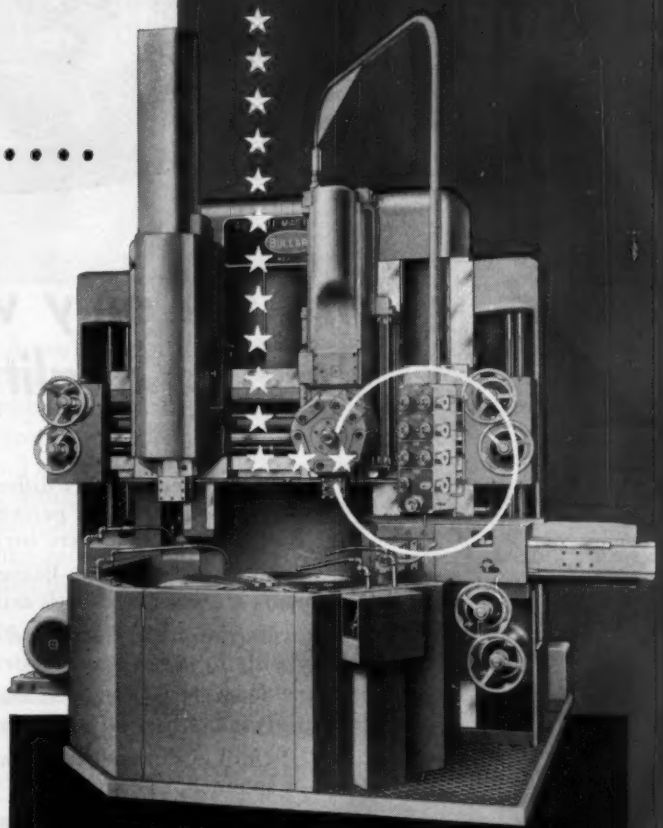
Additional features include:

SCREW FEED

for vertical and horizontal motion of all heads — to assure fine smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET (optional)

Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.



CUTMASTER VERTICAL TURRET LATHE Model 75

PLAN TO VISIT OUR EXHIBIT AT BOOTH 1213 AT THE N.M.T.B.A. SHOW, CHICAGO . . . .

SEVENTY FIFTH 1880 BULLARD 1955 ANNIVERSARY

THE BULLARD COMPANY

BRIDGEPORT 2, CONN.

AVAILABLE IN 26, 36, 46, 56, 66 AND 76 INCH SIZES

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

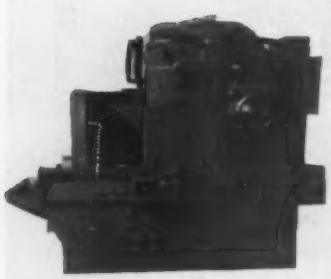
Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to ***"PUT IT ON THE BLANCHARD".***

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!



Send for free copies of "Work Done on the Blanchard"

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

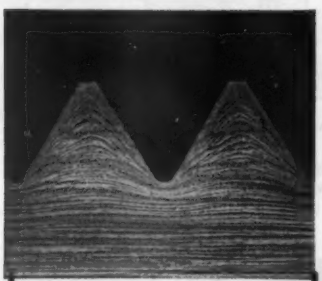
when specifications call for

THREADING from the end

roll threads on your present equipment

with a small investment

investigate National Acme "FETTE" Thread Rolling Heads



PROVIDES STRUCTURAL ADVANTAGES OF COLD-FORMING

Material rolled flows in an axial direction with slight, radial pressure so that the thread is generated ahead of the rolls. This causes metal to flow to full depth of thread and eliminates broken grain structure and cratering at thread crest. Resulting surface hardening and densifying provides a high grade burnished thread surface remarkably resistant to wear and corrosion.

National Acme "Fette" Thread Rolling Heads and Rolls, *installed on your present turning equipment*, provide a profitable method with which you can do your own thread rolling. They will save you time and give you better control over threading quality and deliveries. Available at only a fraction of the investment you would have in specialized equipment, these self-opening thread-rolling heads can be used right in with your tooling setup on turret lathes or automatics—or to utilize second operation equipment for producing rolled threads.

These heads are available in two types—for revolving or non-revolving spindles. With them, you can roll threads with extreme accuracy and smoothness, at speeds equal to turning speeds of high-speed-steel tools.

For complete details, write today for Bulletin FRH-53B.

OUR JOB: to provide the *Right Machine* for YOUR JOB

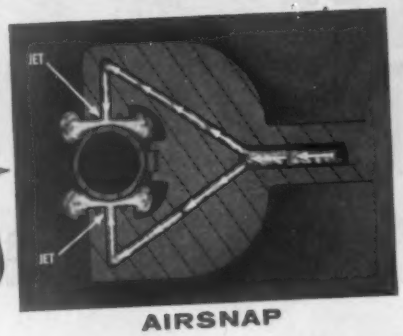
Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

171 EAST 131st STREET • CLEVELAND 8, OHIO

Check EXTERNAL*

BASIC TOOLING ELEMENTS

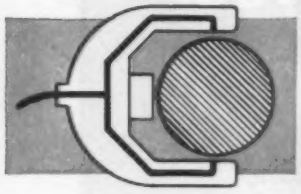


AIRSNAP

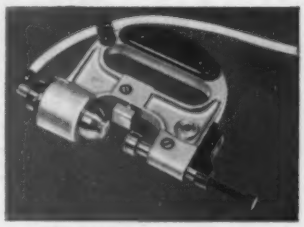
PLUNJET CARTRIDGES

AIR RING

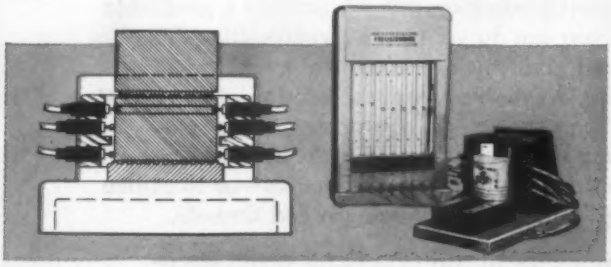
Outside Diameter



● Airsnap having two opposed standard jets, where tolerance is .002" or less and surface finish is less than 65 rms.



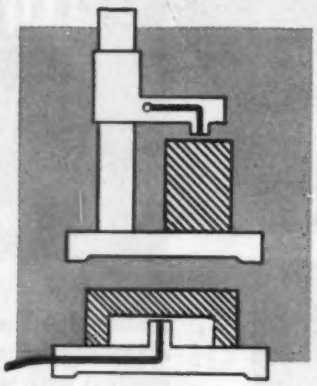
● Adjustable Airsnap with Plunjet Cartridge opposed to the adjustable anvil.



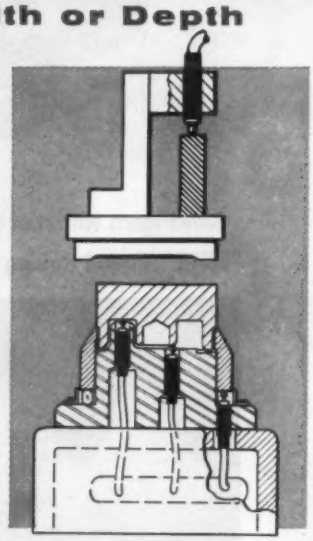
● Fixture in which are mounted two or more Plunjet Cartridges.

● Air Rings and Air Pots for true diameter, average diameter and out-of-round.

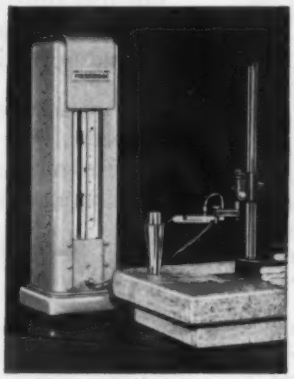
Height, Width or Depth



● Gage incorporating one standard jet where tolerance is .005" or less and surface finish is less than 65 rms.

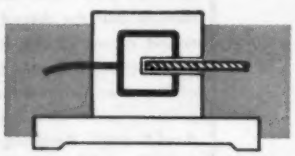


● Gage incorporating one or more Plunjet Cartridges.



● Airetest Indicator.

Thickness



● Gage incorporating two opposed standard jets—especially for thin parts, gage blocks, etc., having close tolerances.

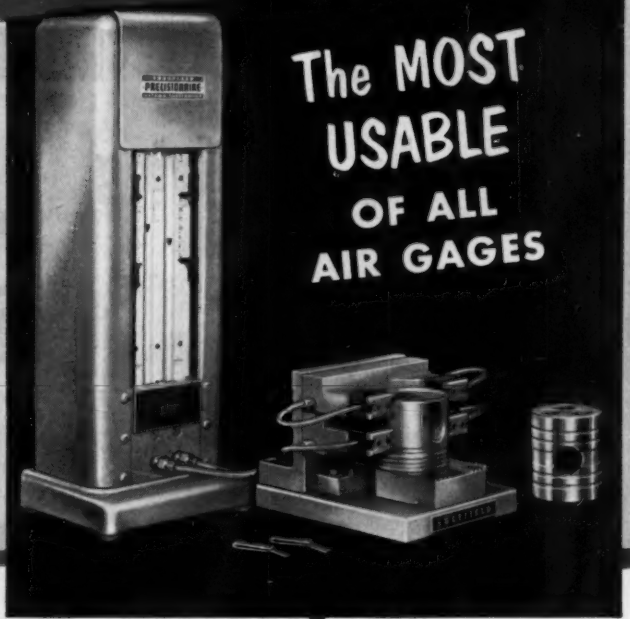
Contour

● Multiple Plunjet Cartridges mounted in a suitable fixture.

MORE PRECISIONAIRES BOUGHT THAN ALL OTHER MAKES

DIMENSIONS and SURFACES

with SHEFFIELD'S PRECISIONAIRE



CHARACTERISTICS

High precision with instant response

•

Has widest amplification range—100 to 100,000:1

•

Accommodates widest tolerance range—.000005 to .100

•

Amplifications and tooling interchangeable

•

Provides quickest change in amplification

•

Longer scale facilitates classifying parts and provides greater approach range

•

Easier to read—no need to squat and squint

•

Human error minimized

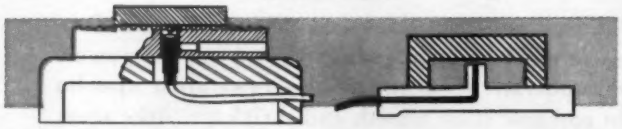
•

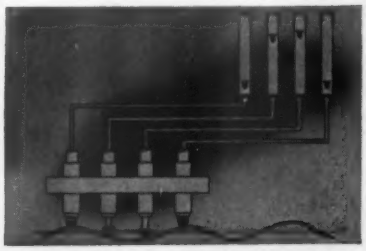
Checks one dimension or many simultaneously

•

Elements have long service life

Flatness

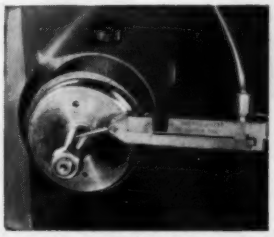




● A standard Air Jet or Plunjet Cartridge inserted in a precision surface plate, granite or steel.

● Multiple Plunjet Cartridges mounted in a suitable gage.

Shaft Runout

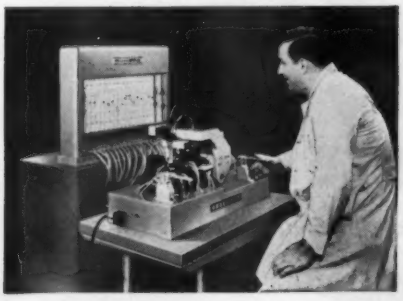


● Airetest Indicator.

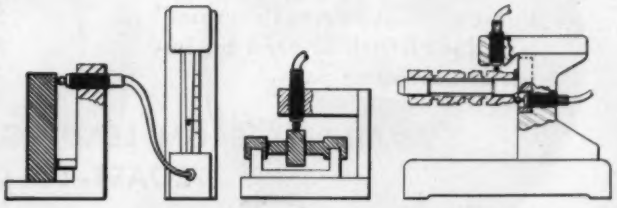
Squareness of Surfaces or Concentricity

● Fixture incorporating one standard jet for close tolerance parts having good surface finish.

Simultaneous Multiple Checking



● As many dimensions as 36 or more are being checked simultaneously to high accuracy on Sheffield Multiple Dimension Precisionaire Gages.



● One or more Plunjet Cartridges mounted in a suitable gage.

* For checking internal dimensions, relationships and countless other conditions, write Instrument Division No. 600, THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.

7221

OF AIR GAGES COMBINED

SHEFFIELD

DoALL COMPANY ENGINEERS GET...

HIGH STRENGTH

with NO HEAT TREAT DISTORTION

by specifying

STRESSPROOF®

SEVERELY COLD-WORKED, FURNACE-TREATED STEEL BARS

The new giant DoALL Contourmatic band saw — the world's largest — is a key part of the Air Force's "Heavy Press Program." STRESSPROOF is used on important operating parts.

on key operating parts

The lead and feed screws on the new DoALL Contourmatic must be strong since they transmit power. These important lead and feed screws must also be straight and free from growth and shrinkage, since upon their accuracy depends the accuracy of the huge extrusion dies machined on the saw. STRESSPROOF gives them this strength and accuracy.

STRESSPROOF was specified because it eliminates heat treating and its attendant distortion and warpage problems. In addition, STRESSPROOF wears well, has the necessary strength and is easily machined.

STRESSPROOF makes a better part at lower cost.

Write for helpful data bulletin No. 15 . . . "Improve Quality — Cut Costs"

AVAILABLE FROM LEADING STEEL DISTRIBUTORS COAST-TO-COAST

La Salle STEEL CO.

1416 150th Street, Hammond, Indiana

MANUFACTURERS OF AMERICA'S MOST COMPLETE LINE OF QUALITY COLD-FINISHED STEEL BARS

A NEW PERSPECTIVE IN PRODUCTION

WITH LODGE & SHIPLEY *Powerturn* LATHES

It's time to take a new view of lathe economics. Whether the lathes in your plant are used for production or general purpose, you should be sure that they are producing as economically as possible. Lathes only a few years old may be liabilities from the standpoint of truly low cost production.

New Lodge & Shipley POWERTURN Lathes are designed in every way to facilitate turning to higher levels of profitable operation. Among many new features is the exclusive Computing Head which makes speed selection virtually automatic since the head indicates correct speed lever settings.

With all the new features, these Lathes offer traditional Lodge & Shipley rugged strength, power and accuracy. Get the facts now. "Up-date" lathe facilities for profitable production. Write for detailed literature: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

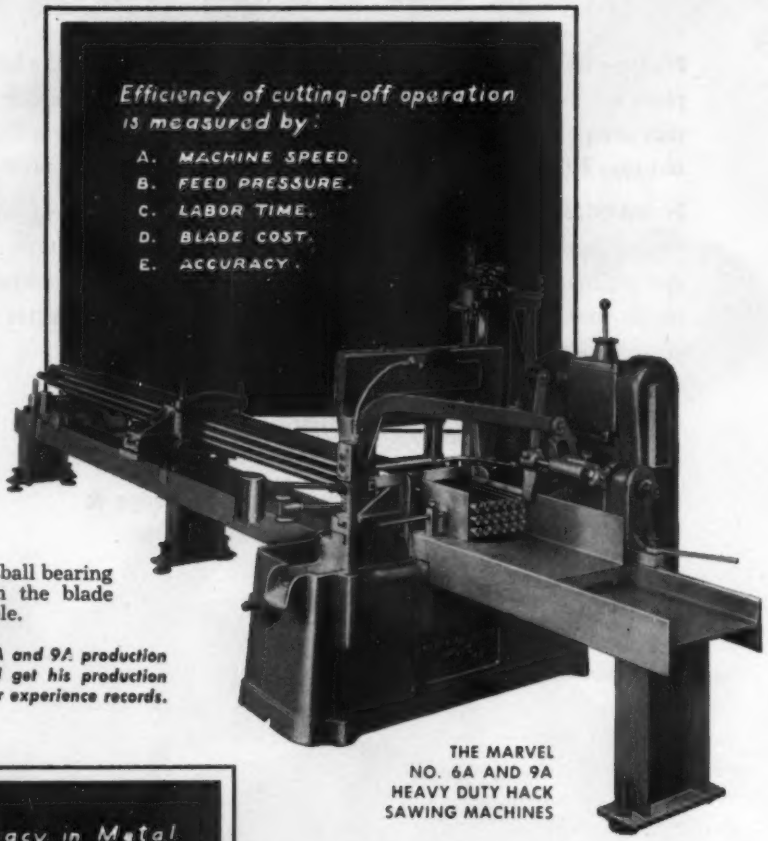
16" POWERTURN Engine Lathe
(also manufactured in 13" and 20" Standard sizes, in Toolmaker, Gap, Manufacturing and 45° and 90° COPYMATIC models)

more than ever before . . .
your LODGE-*ical choice is*

Lodge & Shipley

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack saw blade—the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.

Write for catalog C-55—showing and describing eleven different series of Metal-Cutting Sawing Machines and MARVEL-High-Speed-Edge Hack Saw Blades and Hole Saws.

The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

NEW

No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

No. 3-36
HYDRAULIC MILLING MACHINE

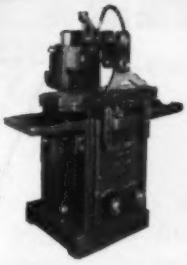
Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

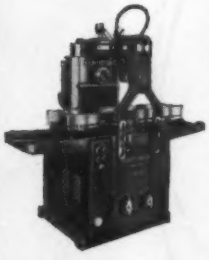
Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient

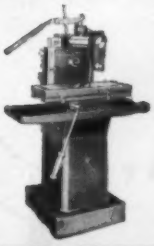
No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.



No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.



No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

Call on

KENT-OWENS
for MILLING MACHINES

KENT-OWENS REPRESENTATIVES

BOSTON
General Machinery Corp.

BUFFALO
Beaver-Hofmann Mach'y Co.

CHICAGO
Four States Mach'y Company

DALLAS
Western Machine Tool Co.

DAYTON
C. H. Gramer Mach'y Co.

DETROIT
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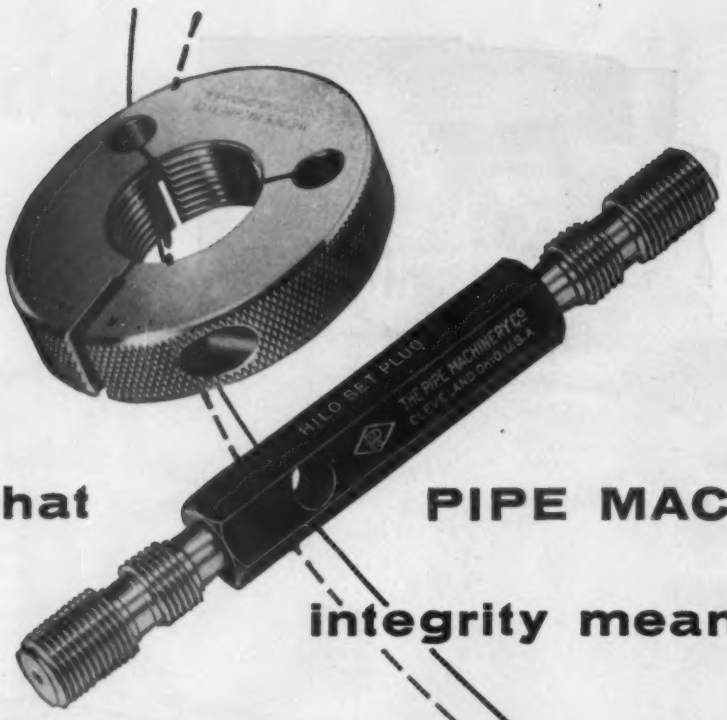
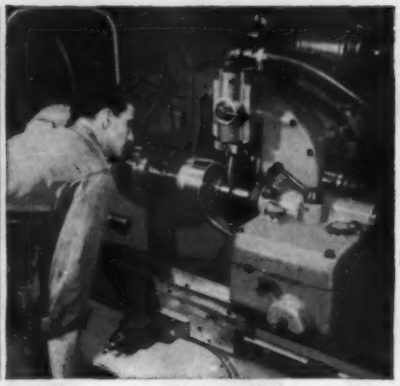


what PIPE MACHINERY CO. integrity means to you

Tapping the i.d. of #00-96NS Thread Ring Gage with .035" tap we machined.

Grinding stand off of a PMCo 4½" A.P.I. Full Hole Rotary Tool Joint Working Plug.



Grinding a PMCo A.P.I. Plug Gage on one of our automatic thread grinders.

Good steel, fine machines, the very best inspection instruments, (all of which we use) are valueless in themselves.

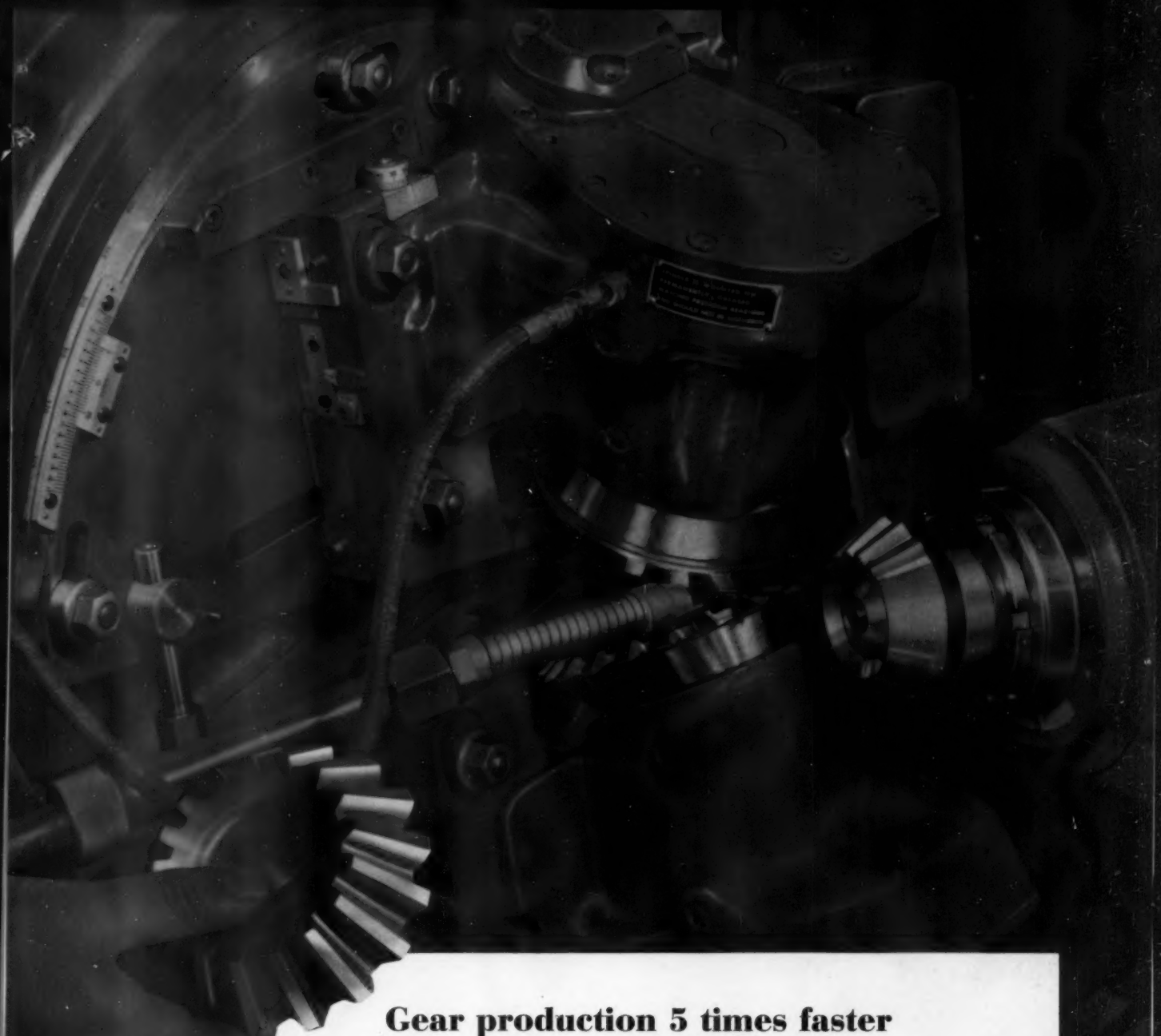
Pipe Machinery has put full value in them for you by adding a priceless ingredient — integrity.

Integrity instilled in the minds and hearts of our group of highly skilled, high principled craftsmen fired with but one purpose: — to produce the best possible gages for you.

The gages they furnish you will save dollars by protecting your product.

Send for our #10 Catalog — or better yet — when you are in Cleveland, stop in and get acquainted.

THE PIPE MACHINERY COMPANY
29100 LAKELAND BLVD. • WICKLIFFE, OHIO
Greater Cleveland



Gear production 5 times faster with this generator!

• Bevel gears with localized tooth bearing cut from the solid in *one* operation by the new Gleason No. 104 Straight Bevel Coniflex® Generator. Production rates increased 5 to 1. Excellent quality is maintained. Quick set up makes machine ideal for small or large quantity production.

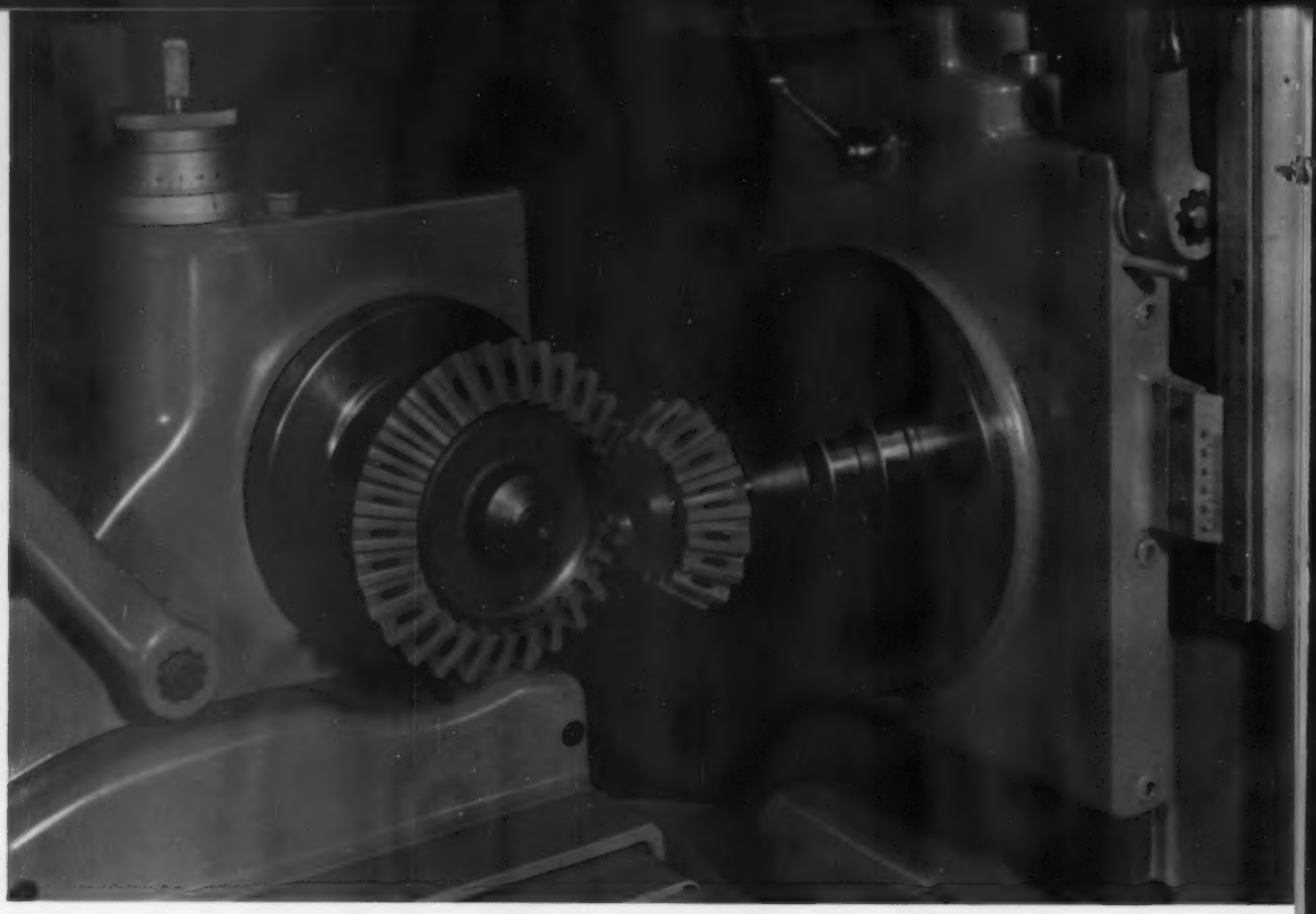
On the reverse side are the tester and sharpener used with the No. 104 Generator. A complete unit of generator, tester and sharpener gives you all of the facilities you require for quality Coniflex gear production.

Write us. We will be pleased to send you bulletins and further information.

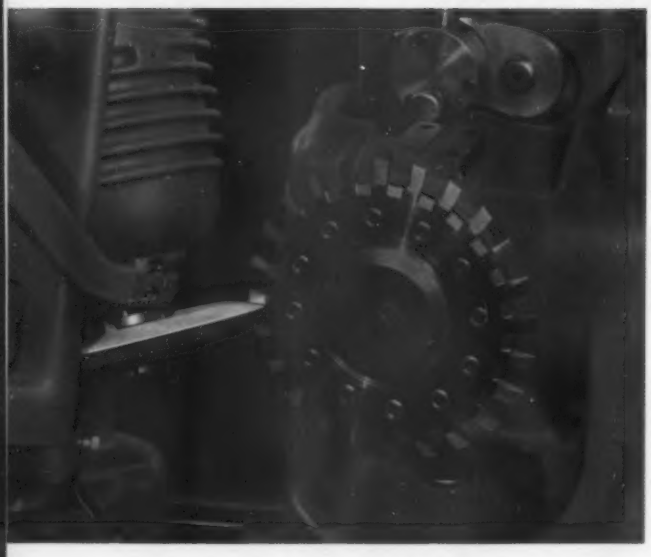
GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



Complete your gear production facilities with these auxiliary machines



• In addition to the generator, gear testing and cutter sharpening equipment is absolutely necessary for economical bevel gear production. The No. 13 Universal Gear Tester shown above, and the No. 104 Coniflex® Cutter Sharpener shown left, are the companion machines used with No. 104 Straight Bevel Coniflex Generator on the reverse side of this page.

The No. 13 Tester provides a running test for a wide range of bevel and hypoid gears. Smoothness and quietness of operation, tooth bearing, tooth size, concentricity and tooth spacing errors are all checked by the running test. It simulates actual operating conditions and determines if the gears are correct before final assembly.

Accurate sharpening of the No. 104 Sharpener assures longest cutter life, best finish on gears, and exact duplication of results after cutters are sharpened or replaced.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

Four Of A Kind For Better Barrel-Finishing. The new Norton Tumblex "T" abrasive brings you an unbeatable combination for top performance: non-wedging triangular shape; fast-cutting bonded ALUNDUM* abrasive; and four sizes for the widest range of applications.

Brand new! . . . Norton TUMBLEX "T" — bonded, triangular shape tumbling abrasive

Users report Tumblex "T" abrasive brings many new "TOUCH of GOLD" benefits to barrel-finishing

Here's one of the most revolutionary barrel-finishing innovations ever developed. In typical on-the-job tests, Norton customers report that the new Tumblex "T" tumbling abrasive:

- ***"cuts tumbling cycle time from five hours to one hour."***
- ***"finishes steel and magnesium parts that could never before be barrel-finished."***
- ***"completely removes burrs from stainless steel parts in four hours. Abrasives previously used failed to do so in 12 hours."***

Everything about Tumblex "T" abrasive is designed for better barrel-finishing.

Its uniform triangular shape and size prevents wedging in recesses of parts.

Made of famous Norton ALUNDUM abrasive, it cuts fast, with no compound needed — resulting in shorter time cycles and lower costs per piece finished.

It provides maximum surface contact with parts being processed, assuring top quality work in fastest time.

It wears down evenly, keeping the same triangular shape. No small chips to lodge in holes, slots, etc. — and when worn down it can be used on parts requiring a smaller size abrasive.

Its lightness means less weight required to fill the barrel. Results are more uniform finish, without roll-in or roll-over of edges of parts.

Its chemical inertness, unaffected by acids, compounds or detergents, prevents spoilage common to other types of abrasive.

Send Your Work Samples

to our newly enlarged Sample Processing Department. Let us prove to you how the latest barrel-finishing equipment and techniques can improve your product quality and cut your finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

G-294

NORTON

ABRASIVES

Making better products... to make your products better

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION: Coated Abrasives Sharpening Stones • Pressure Sensitive Tapes

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NIAGARA FRONT-TO-BACK

ALL NEW rugged, front-to-back crankshaft with huge crankpins

ALL NEW compact, fully concealed driving mechanism

ALL NEW enclosed, rigidly supported gearing in sealed oil bath

ALL NEW electro-pneumatic friction clutch on crankshaft

ALL NEW wider spaced, longer, narrower gibs

ALL NEW wider, box type slide all within gibbing

ALL NEW precision, hardened, longer-wearing gears

ALL NEW compact, straight-line, space-saving frame

Hailed as the greatest achievement in modern OBI press design and performance, by over 100,000 spectators who examined this mechanical marvel at the Machine Tool Show, the all-new Niagara Series E, Single Point, Open Back Inclinable Press starts a brand new chapter in press history.

It's years ahead of any OBI ever built. It's an industrial revolution all by itself. No other press, in modern times, embraces so many "All-New" features.

Gone are exposed, overhanging gears, flywheel and other mechanisms. Gone is excessive and damaging crankshaft deflection. Here to stay are: Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide, with minimized tendency to cock. Substantially increased die life. Longer lasting, hardened gears. Smoother, safer press performance. Smaller floorspace requirements.

Built in 4 sizes, with shaft diameters from 4½ to 7½ inches and capacities from 75 to 200 tons, the new Series E is available in both standard models and automation models equipped with the most advanced controls and devices for peak production. A complete description of both, with full specifications, is given in new Bulletin 56, sent promptly on request.

SEND FOR NEW BULLETIN . . .

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

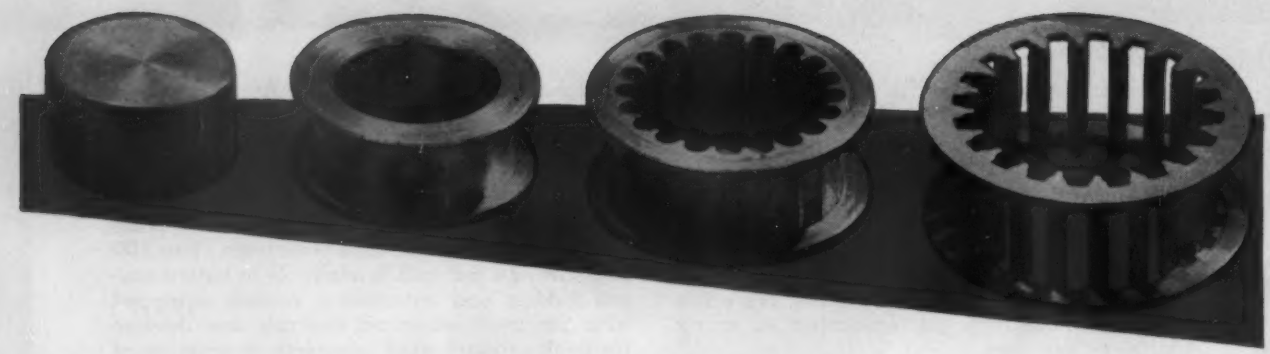
Dealers in principal U. S. cities and major foreign countries.

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work.

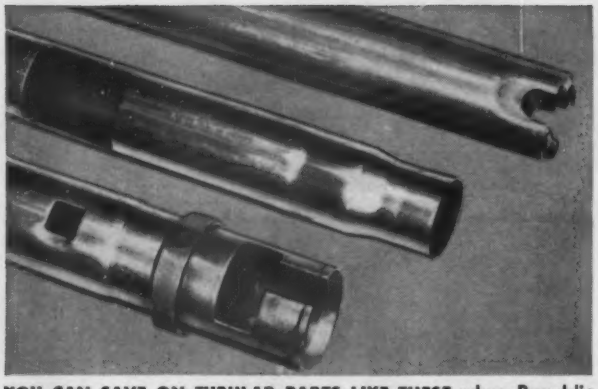
CRANKSHAFT-OBI PRESS DESIGN

STANDARD DESIGN
For General Purpose Production

MODIFIED DESIGN
For Automation Lines



Republic Alloy Steels help Johnson make dependable



YOU CAN SAVE ON TUBULAR PARTS LIKE THESE when Republic does the tube fabricating. Republic's Steel and Tubes Division is equipped to handle all kinds of tough fabricating jobs—has the machinery, the experience and the ability to work out the most economical method of making quality tubular parts. And that includes complete assemblies.

SAVE UP TO 66% OF YOUR STORAGE SPACE with Republic Collapsible Boxes. This PB-127 unit solves the problem of storing and shipping empty boxes. It's designed for heavy-duty service. Can be tiered when loaded or empty—collapsed or set up. It is a one-piece unit. Pin and slide belt arrangement assures positive locking.

REPUBLIC STEEL CORPORATION
3102 East 45th Street
Cleveland 27, Ohio

REPUBLIC STEEL

Please send more information on:

☐ Cold Drawn Alloy Bars ☐ Boxes and Skids
☐ Mechanical Tubing ☐ Free-Machining ENDURO®

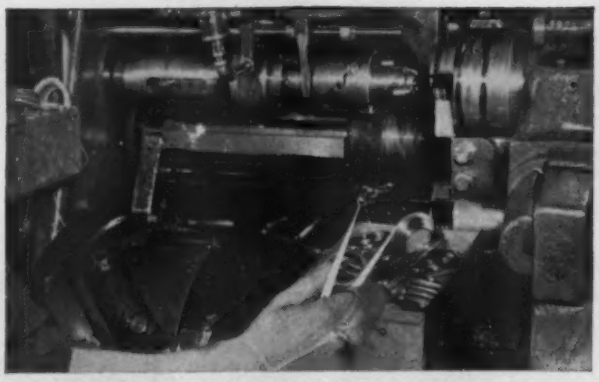
Name_____ Title_____

Company_____

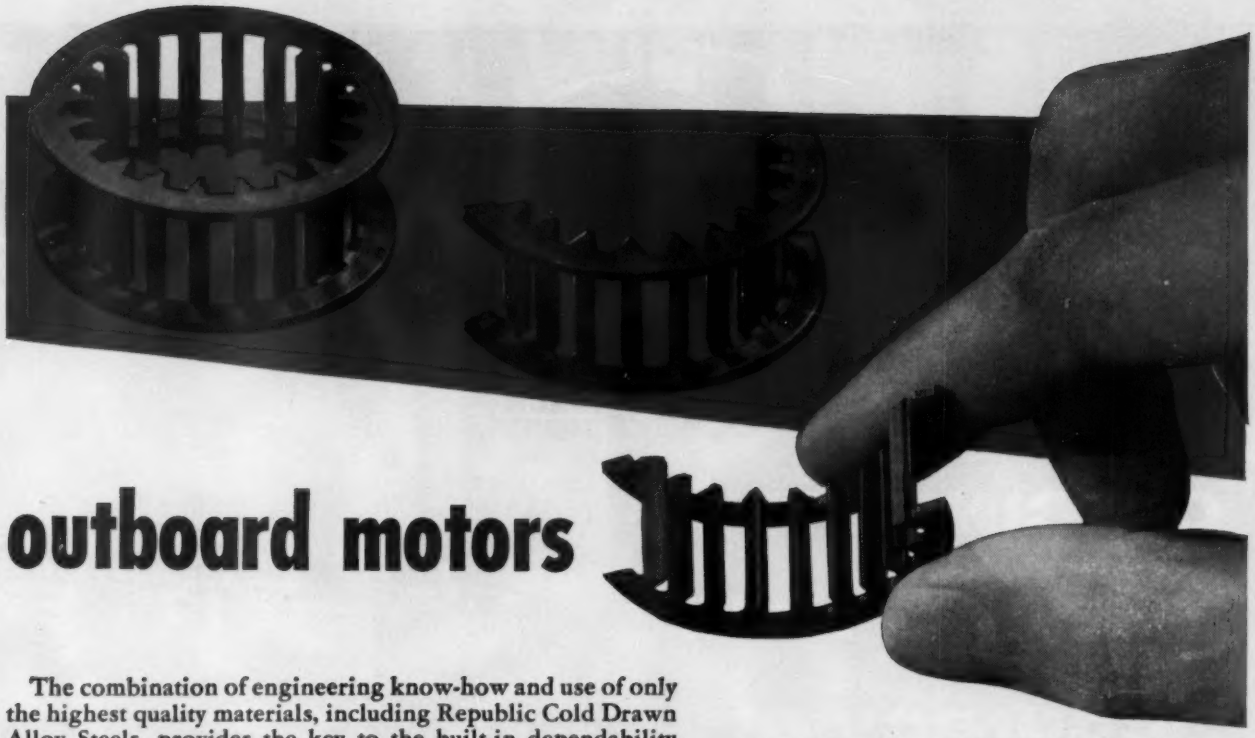
Address_____

City_____ Zone____ State_____

E-3278



GIVE YOUR DUPLICATE PARTS THE HIGH MECHANICAL and corrosion-resisting properties of stainless steel. Do it without a heavy production penalty. Simply set up and run Free-Machining ENDURO Stainless Steel Bars. Two grades are fully 90% as machinable as Bessemer screw stock. These high-quality, cold drawn bars provide close tolerance, accuracy of section, uniform soundness, a fine surface finish. Available in hot-rolled bars as well as cold finished bars and wire.



outboard motors

The combination of engineering know-how and use of only the highest quality materials, including Republic Cold Drawn Alloy Steels, provides the key to the built-in dependability of Johnson Sea-Horse Motors.

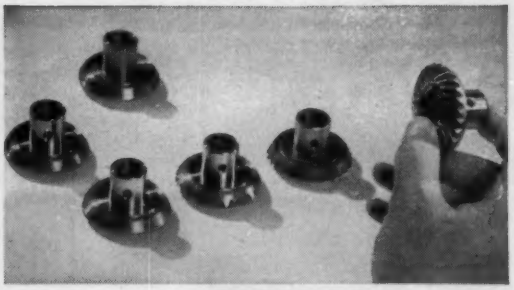
Highly machined parts, such as the connecting rod bearing retainer shown above and the spiral bevel gears that drive the propeller shaft and other parts, are made from Republic Cold Drawn Alloy Steels.

As in many new product developments, certain difficulties were encountered in the initial stages of production. The bearing retainer, considered to be one of the most difficult parts in existence to machine, is a case in point.

During rough broaching, chips welded to the broach and tearing of the metal occurred on bearing pockets. A Republic Field Service Specialist was invited to work on this problem with Johnson Engineers. A solution was worked out through close cooperation and teamwork. The blanked parts were heat-treated to increase Brinell hardness. Broaching improved immediately. Chip adherence was eliminated. Surfaces were much smoother.

Republic supplies Johnson with cold drawn alloy steel bars for better machinability, longer tool life and the fine finish needed for parts on their new line of quiet motors.

You can put these qualities of Republic Cold Drawn Alloy Bars to work in your steel parts—plus high strength, close tolerance, toughness, hardenability, accuracy of section. And Republic metallurgists and machining specialists stand ready to help you uncover the answers to tough cost and production problems, ready to help you get the most out of the Republic Cold Drawn Alloy Bars you buy. The coupon will bring you more information.



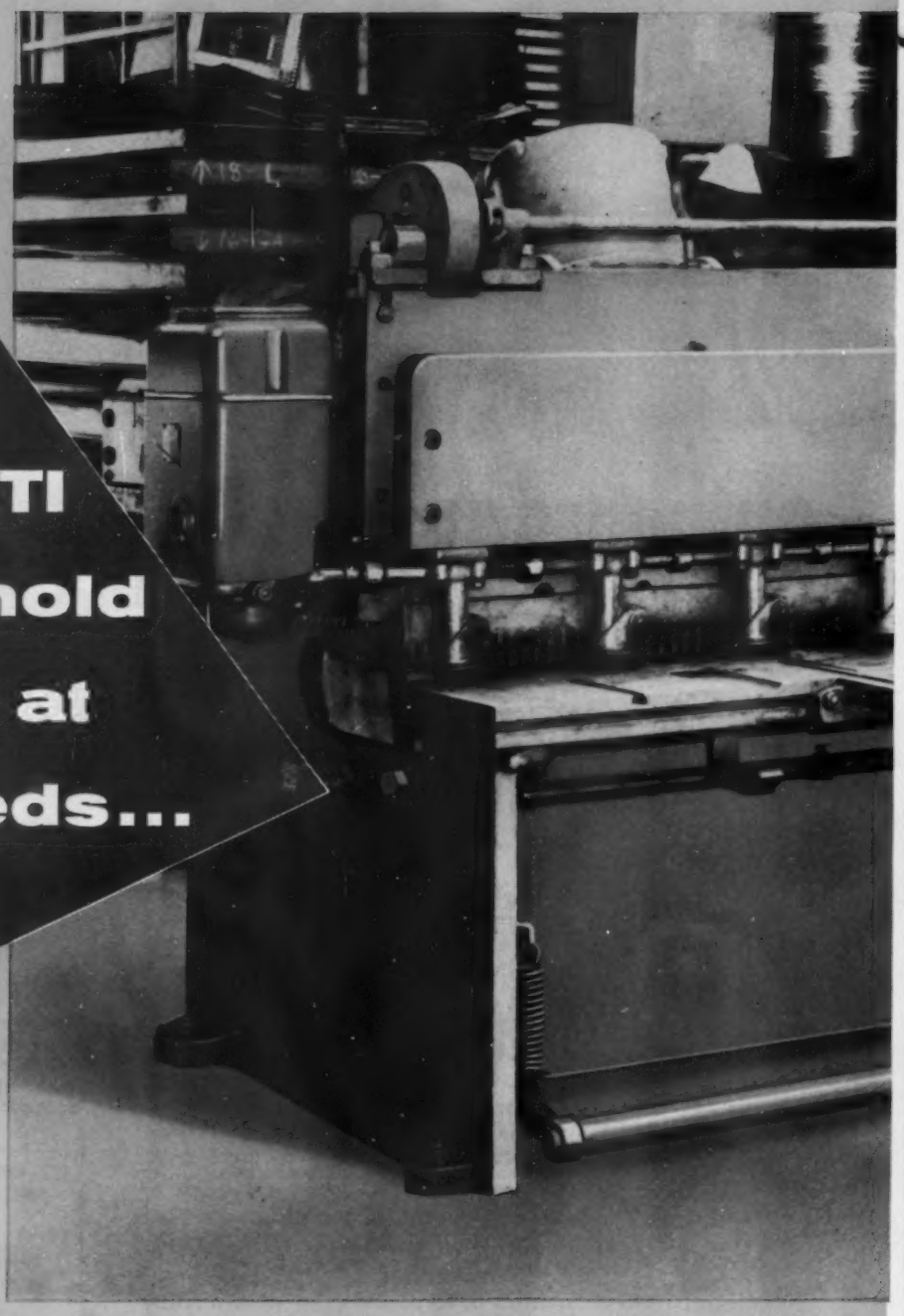
Gear action on Johnson Motors is smooth, positive, quiet. Photo illustrates sequence of machining operations performed on the spiral bevel gears that drive the propeller shaft. Republic Cold Drawn Alloy Steels give these parts added strength and a fine surface finish.

REPUBLIC STEEL

World's Widest Range

of Standard Steels and Steel Products

CINCINNATI SHEARS hold accuracy at high speeds...



at **THE HOELTGE BROS., INC.**
Cincinnati, Ohio

For seven years, this Cincinnati Shear has given trouble free performance on manufacturing and jobbing work, blanking 3/16" and lighter steel sheets.

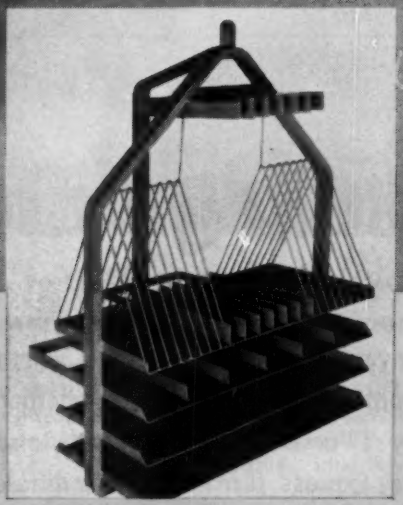
These Cincinnati features are profitable at Hoeltge Bros.:

- Hydraulic holddowns.
- Four-edged knives.
- Accurate back gauge.
- Easy operator control.

Save time with a Cincinnati Shear. They cut materials of various thicknesses without changing knife clearance.

Investigate these money making Cincinnati Shears. Write for Catalog S-7.

Photos courtesy Hoeltge Bros., Inc., Cincinnati, Ohio.



4′ x 3′ x 2′ Overhead Conveyor carrier.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

Manpower's amazing and here is the proof:
When shipping costs grew, the boss raised the roof . . .

Now the roof's back in place and the future looks bright,
Swift **RAILWAY EXPRESS** keeps his shipping costs light.

The big difference is

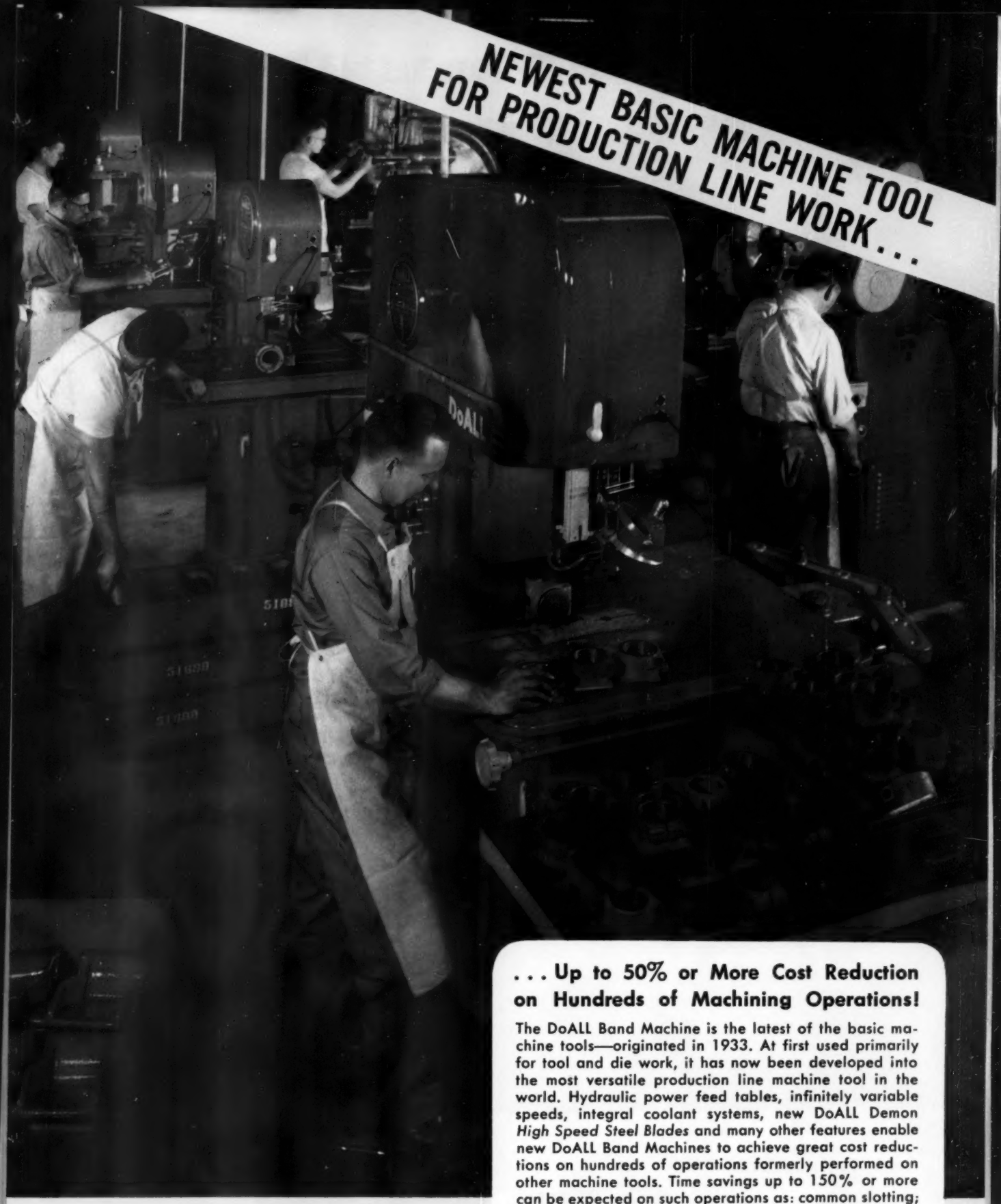
Whether you're sending or receiving, whether your shipment is big or small, and whether it's moving by rail or air—you'll find it pays to specify Railway Express. It makes the big difference in speed, economy, and safe, sure delivery.

• • •

Railway Express uses the facilities of some 480 independent and competitive transportation companies in the movement of express traffic. It's free enterprise at its best, putting at your service one-third of a million miles of co-ordinated rail, air, water, and truck routes that connect all America.

RAILWAY EXPRESS AGENCY

. . . safe, swift, sure



. . . Up to 50% or More Cost Reduction on Hundreds of Machining Operations!

The DoALL Band Machine is the latest of the basic machine tools—originated in 1933. At first used primarily for tool and die work, it has now been developed into the most versatile production line machine tool in the world. Hydraulic power feed tables, infinitely variable speeds, integral coolant systems, new DoALL Demon *High Speed Steel Blades* and many other features enable new DoALL Band Machines to achieve great cost reductions on hundreds of operations formerly performed on other machine tools. Time savings up to 150% or more can be expected on such operations as: common slotting; splitting; notching; trimming; contour cutting; cutting grinding reliefs, and many others.

The following pages explain the remarkable versatility and economy of this new machining concept.

DoALL

The DoALL Company
Des Plaines, Illinois

Please turn the page for details. ——→

How the Versatility of the

WITH OTHER MACHINE TOOLS . . .

In milling or surface grinding, cuts are made in one direction

OR . . .

In planing or shaping, cuts are made in one direction

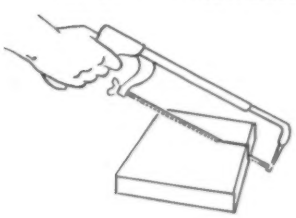
OR . . .

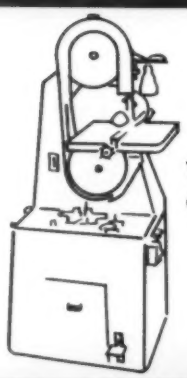
On the lathe, cuts are made on surfaces of rotating workpiece

Look · · · What Band Machining Can Do!

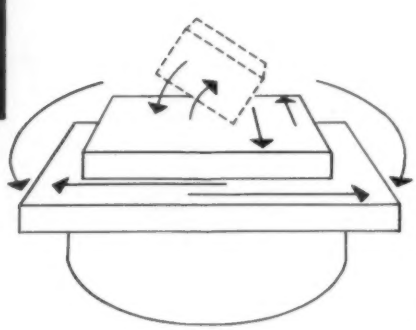
Complete Remote Control on World's Largest Band Machine. The tremendous capabilities of the band machine are clearly shown in the picture at the left. It's the world's largest band machine — used by Alcoa at Lafayette, Indiana, to make accurate internal cuts in extrusion dies up to 36″ diameter by 30″ depth! Three synchronized remotely controlled power tables guide the work in any desired direction into the continuous-cutting band tool. The operator follows the layout line by periscope from his control station.

FIRST . . . The hacksaw.





THEN . . . The DoALL metal cutting band saw.

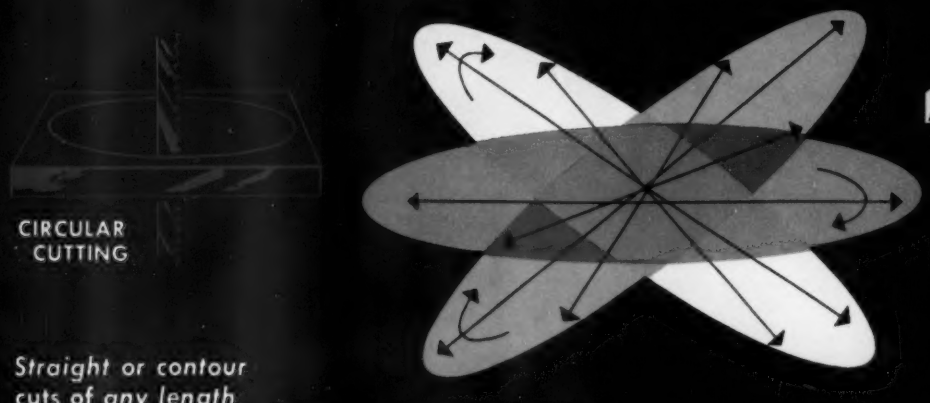


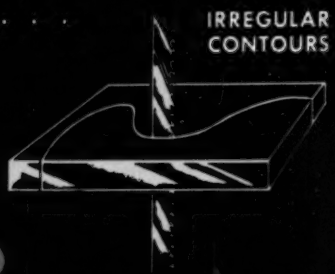
NOW . . . A complete remote control power feed machine tool using a continuous band cutting tool.

All this in just 22 years . . . fastest basic machine tool development in history . . . and the most versatile machine tool ever developed.

Band Machine Reduces Costs

BUT WITH A DoALL BAND MACHINE . . .





Straight or contour cuts of any length can be made in any direction and at any angle.

Why You Can Produce More—

faster and at lower cost with a DoALL band machine

Plants that have applied band machining to production machining have experienced cost reductions ranging from 10% to 90% as compared to the costs on other machine tools. Here are some of the reasons for these remarkable savings:

CUTS FASTER! Because it is thin, has many teeth (1500 or more) cuts continuously and runs at relatively high velocities, the band tool penetrates material faster. Cutting only a narrow slot, the tool "slices" through work, removes an entire section of metal intact instead of slowly nibbling it down into a pile of chips. *(Friction sawing speeds range up to 15,000 blade feet per minute!)*

LOW COST TOOLS! DoALL Band Tools, especially the amazing Demon High-Speed Steel Band, will machine up to 10,000 square inches of mild steel at 10 square inches per minute. In terms of work output per hour, no other cutting tool can compare!

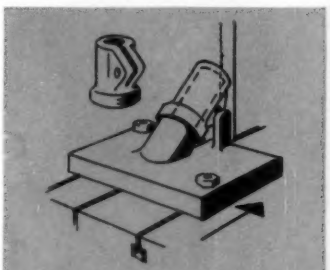
FIXTURING IS SIMPLER! Cutting force is in the direction of the table. Back-up bars or other simple, low cost fixtures are all that are required to hold work in position as the power feed table carries it into the blade for straight cuts. Fixtures often cost but 1/10 to 1/2 of those for other machine tools. Many can be improvised in a short time.

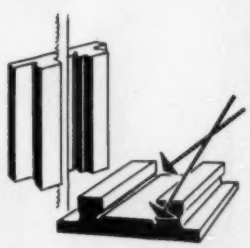
LESS SET-UP TIME! The simple fixturing permits the operator to set-up his work in a fraction of the time often required on other machines.

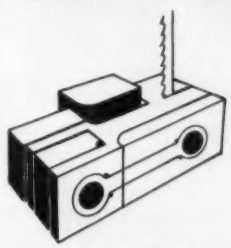
DOES MORE JOBS! The versatility of the band machine increases its usefulness, keeps it on the go, increases return on investment.

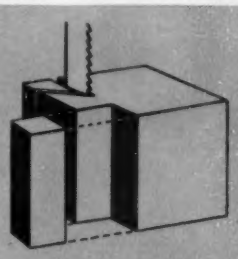
SAVES MATERIAL! In many cases, the sections of costly material saved by band machining can be salvaged for other uses.

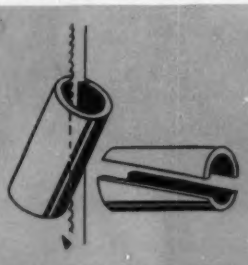
COSTS LESS! A new power-feed DoALL Band Machine often costs but 1/3 to 1/2 as much as other machine tools previously used for many of the same machining operations.

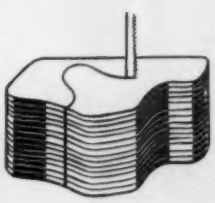

Power feed slotting with simple fixture.


Time-saving cutting of grinding reliefs.


3-dimensional cutting without stock waste.


Notching operations done faster.


Mass production splitting operation.


Multiple cutting in heights to 10" and more.

PROOF . . . FACTS . . . FIGURES

. . . see the next page

Look At These Savings!

SAVES 33 HOURS and $190 TOOL COST—Slots band machined in 1½ ton #4140 forging in 3 hours at a tool cost of $10 per piece. Formerly cut on $25,000 slotter in 36 hours at a tool cost of $200 per piece.

66% SAVING—Rapid trimming with excellent finish by band machining results in 66% saving over former milling operation.

15 TIMES FASTER—Bearings split in 40 seconds on band machine using simple 180° indexing fixture. Former milling time was 10 minutes each.

SECTION REMOVED WHOLE IN 7.8 MINUTES—Steel forging SAE 4340. Nature of task excludes all methods but band machining for speed and efficiency.

FAST ANGLE CUT — NO FIXTURING COST 45 degree cut made on band machine in .25 minutes using simple vise as fixture.

96% SAVING—High temperature fan nickel-chrome steel blades are trimmed to length on band machine with 96% saving over mill. Only a simple index fixture required.

SEE A DEMONSTRATION —

You can see this new machining method without obligation at your own plant. Call your local DoALL Store, or write: The DoALL Company, Des Plaines, Ill.

SEE NEW FILMS—two new sound color films available for group showings:

1. "Production Band Machining"—30 minutes.
2. "Production Tooling"—10 minutes.

. . . revealing the newest concept for cost-reductions in machining. Call your local DoALL Store or write, The DoALL Company, Des Plaines, Illinois.

DoALL

Friendly DoAll Stores . . . (in 37 cities)

Personalized Service . . . Complete Stocks . . . Local Delivery

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DoALL SAW BANDS
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EDUCATIONAL STUDY WALL CHARTS

Economic Principles

$1.00 each postpaid

Lower quantity prices

you can
SAVE TIME
and
MONEY
on
jobs like this
with
the

...GISHOLT SPEED SELECTOR!

HERE'S WHY:

No manual gear shifting! You simply turn this hand wheel or touch a trip lever (for Direct or Pre-set operation). Shifting is automatic—by hydraulic power—while the operator positions the new tools for the next cut.

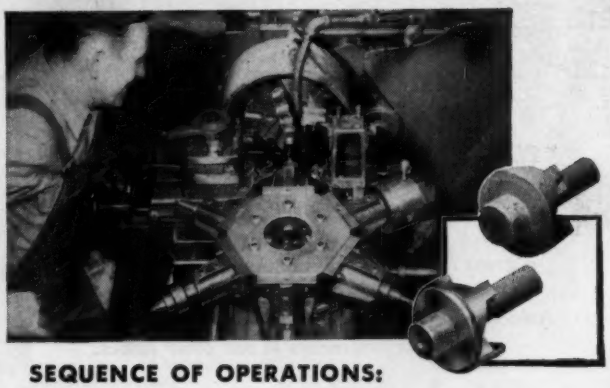
It's all so much simpler with the Speed Selector. There's no need for time-wasting computations, no mental effort, no physical effort. With simple controls, either direct or prearranged, the operator gets the ideal f.p.m. cutting speed for each cut. And it's *much faster,* of course!

The Speed Selector is standard on Gisholt Nos. 4 and 5 Ram Type Turret Lathes and on all Gisholt Saddle Type Lathes.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

HERE'S HOW:



SEQUENCE OF OPERATIONS:

Note the star which indicates each time the Speed Selector is used.

★ **1. Hexagon turret—Center drill at 297 r.p.m. hand feed**

2. Hexagon turret—Support with live center

★ **3. Square turret—Rough turn and face at 96 r.p.m., .003 feed**

★ **4. Square turret—Finish turn, face and chamfer at 126 r.p.m. .002 feed**

★ **5. Hexagon turret—Start and drill through at 226 r.p.m., .003 feed. Trip the Hi-Lo lever, eliminating even the need for turning the hand wheel**

★ **6. Hexagon turret—Thread with tap at 39 r.p.m., leaders and followers**

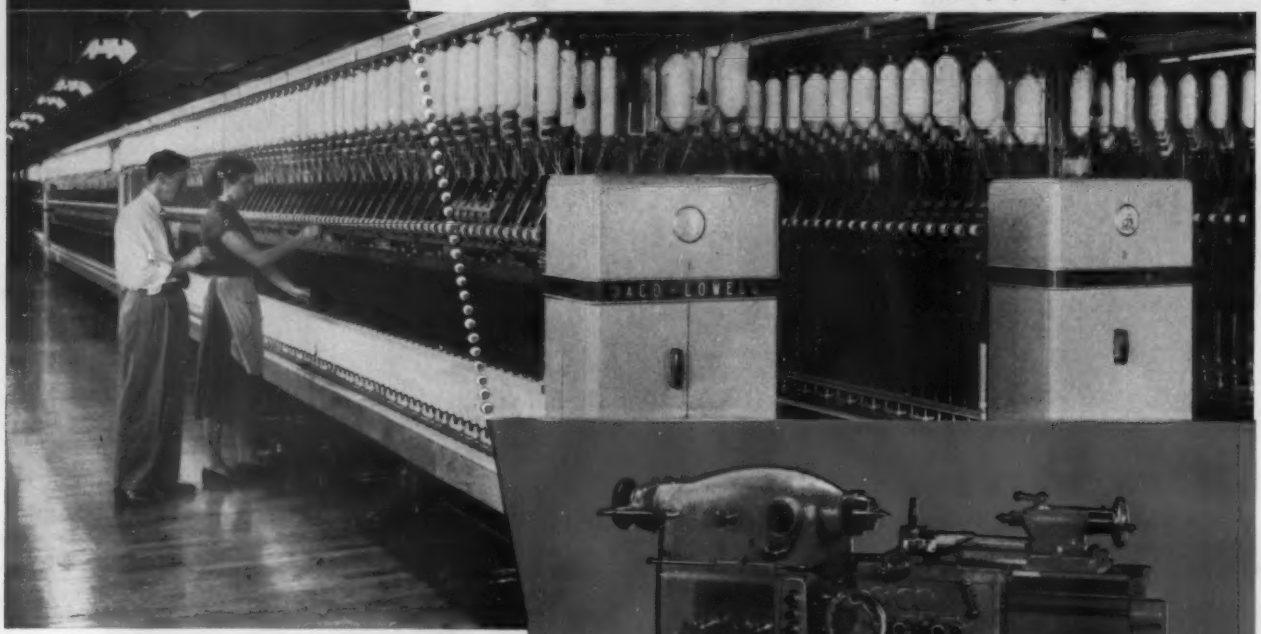
—and you're ready for a new workpiece

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

2 for 1 lathe

. . . zooms tooling quality at world-leading builder of textile machinery!

Saco-Lowell Shops Gwaltney Spinning Frames



Rivett 1020S "Steelway" Precision Toolroom Lathe

SACO-LOWELL SHOPS Biddeford, Me. Reports—

"The Rivett 1020S can handle heavy, rough cuts yet maintain very close tolerances on the finish. Because of its simplicity and quick action, the spindle speed selector is a great improvement over the other lathes in our toolroom. If the Rivett is not in use (which is very seldom), our toolmakers go to it first in preference to our other lathes."

Saco-Lowell believes that on research and development rests the safe future of business. Perfect modeling of better and better textile machinery and equipping to build it profitably call for the best kind of toolroom work. Powerful, fast and accurate lathes are needed to do it. The Rivett 1020S is second to none for bringing to life the inventions and devices of your mechanical engineers, quickly and with precision.

FEATURES

40% heavier than comparable lathes.
Back gearing for power cuts—belt drive for high speeds.
Hardened steel ways with 12¾" spread.
Infinite spindle speeds 22 to 3600 r.p.m.
Push button controls for complete operation.
Neutral clutch stops spindle without stopping drive.
Intermediate spindle bearing prevents deflection.
Collets mount directly in spindle.

RIVETT LATHE & GRINDER, Inc.
Dept. AMR-10, Brighton 35, Boston, Mass.
Send Free 16-Page Bulletin 1020B

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WRIGHT Electric Hoists for Top Production, Easiest Maintenance

WRIGHT *Speedway* Electric Hoists—Frame 1, Frame 2 and Frame 3—are ideal **HOISTS** for handling production materials where the load requirements **ARE** from ¼ ton to 10 ton capacity. Their design includes many advanced **SAFE** operating features. Sound choice of components provides them with **EFFICIENT** balance for smooth running. Parts are designed and built to give **RUGGED** performance with a minimum of care. Plant operating men find them **ADAPTABLE** to almost every type of shop work because of the wide range of speeds, lifts and mountings.

The more particular you are in your selection of hoisting equipment—the more likely you are to choose WRIGHT

Write our York, Pa., office for any or all of these fully informative bulletins—
Bulletin DH-133B on Frame 1 and 1½ WRIGHT Speedways
Catalog E-54A on Frame 2 and 3 WRIGHT Speedways
Bulletin DH-504 on WRIGHT Electric Roller Chain Hoist

ACCO

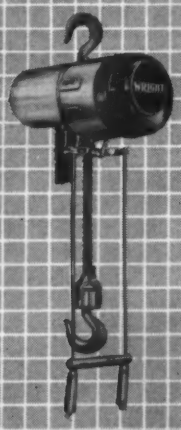
Wright Hoist Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

for Better Value

SPEEDWAY HOIST FRAME 2 FRAME 3

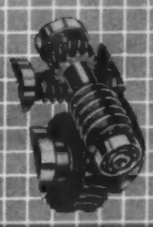
MOTOR BRAKE & SOLENOID FRAME 2 and FRAME 3 HOIST
"Nothing to adjust but the cam!"



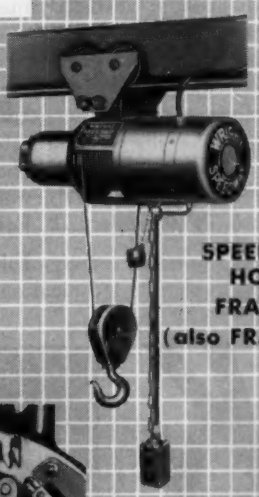
WRIGHT
Electric Roller Chain Hoist

- ¼, ½, 1 and 2-ton capacities
- Fewest number of wearing parts
- Self-locking, double-worm gear acts as own load brake
- Spring-set, shoe-type motor brake, clam shell type
- Oversize precision ball bearings
- Forged steel-alloy hook, swings and swivels

COMPETITIVELY PRICED



THIS DOUBLE-WORM GEAR ELIMINATES TROUBLESOME LOAD BRAKES

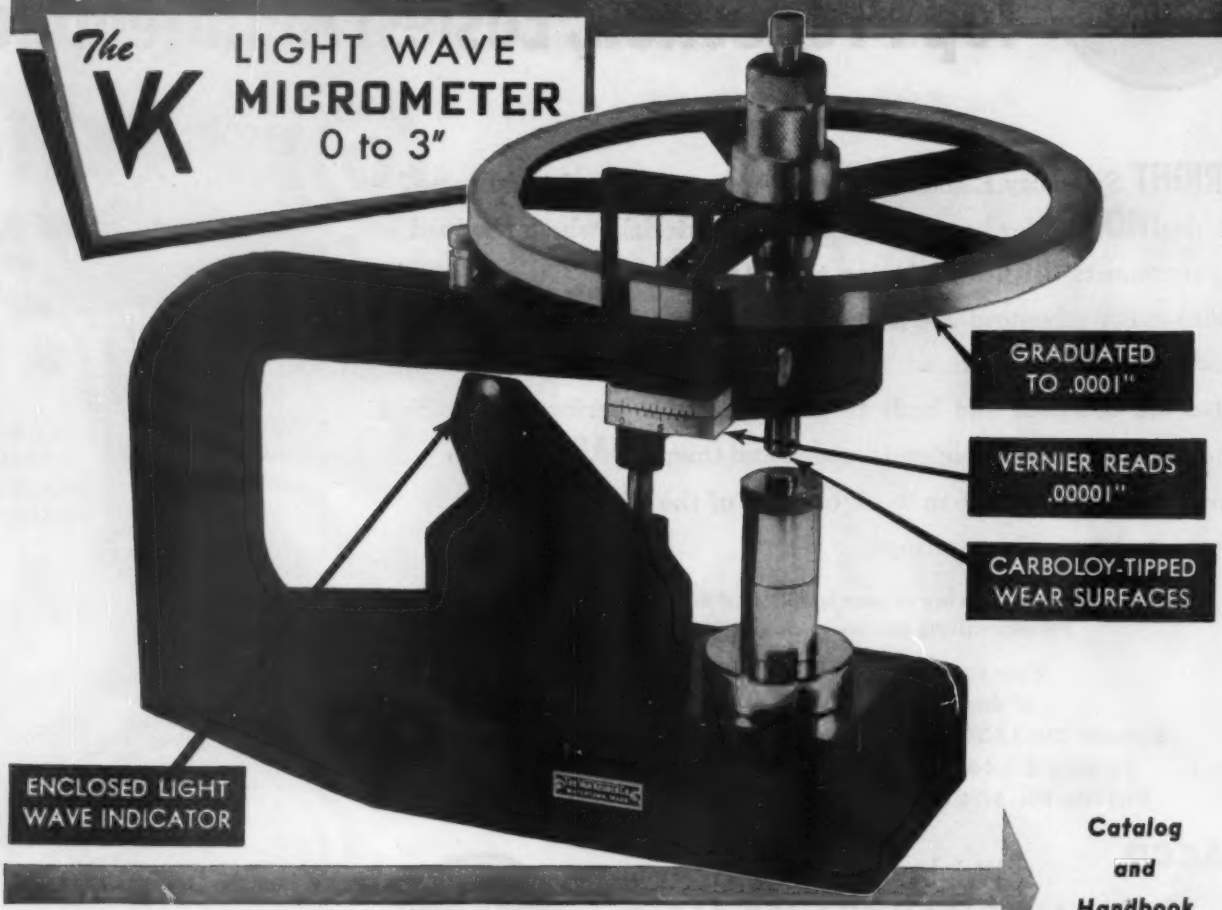


SPEEDWAY HOIST FRAME 1 (also FRAME 1½)

MOTOR BRAKE FRAME 1 and FRAME 1½
"Nothing to adjust but the cam!"

for that last hundred-thousandth

The VK LIGHT WAVE MICROMETER 0 to 3"



The Van Keuren Light Wave Micrometer is an instrument of exceptional accuracy, ideal for measuring plug gages or small precision parts. Use it when you're after "that last hundred thousandth" involved in so many of today's measurements. The 0 to 3" instrument shown above has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy, and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non-parallax vernier index which enables readings to be made to .00001". It has an index lock and carboloy-tipped anvil and spindle. This sturdy, sensitive instrument weighs only 17 pounds, and is in reality a portable measuring machine of inbuilt and sustained accuracy.

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision . . . fast, accurate and profitable.

Catalog and Handbook No. 36

This 258-page volume represents years of research by the Van Keuren Co. It presents a simple and exact method of measuring screws and worms with wires, tells how to me sure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods. Ask for your copy.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

36th YEAR

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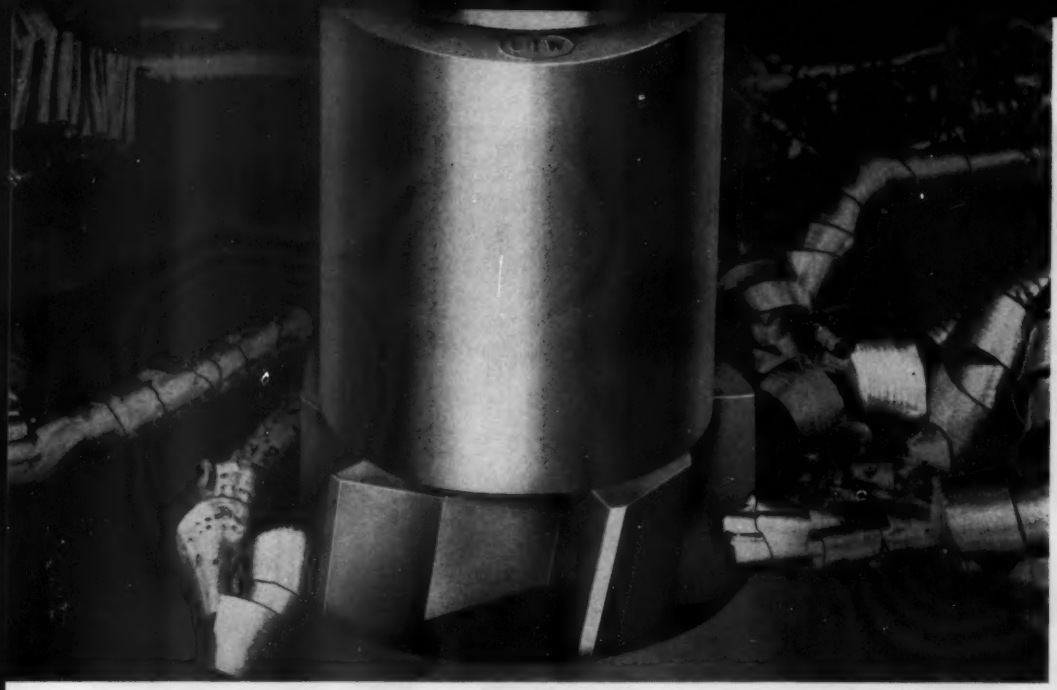
173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.



Counterboring a hole in a steel workpiece. Notice the chip uniformity. Here is evidence of the free-cutting action you get with Continental Counterbores. Double driving lugs on the cutters engage double abutments in the holders to give a balanced, positive drive. Notice, too, the wide cutter flutes aiding in chip disposal.

CTW

How to get smooth cutting and ruggedness with large diameter COUNTERBORES

And even after the toughest cuts the Continental Cutter disengages from the holder with a quick *twist of the wrist.* Because of the shape of the driving members, wedging or jamming cannot occur to delay the interchanging of cutters.

and quick, twist-of-the-wrist disengagement, too

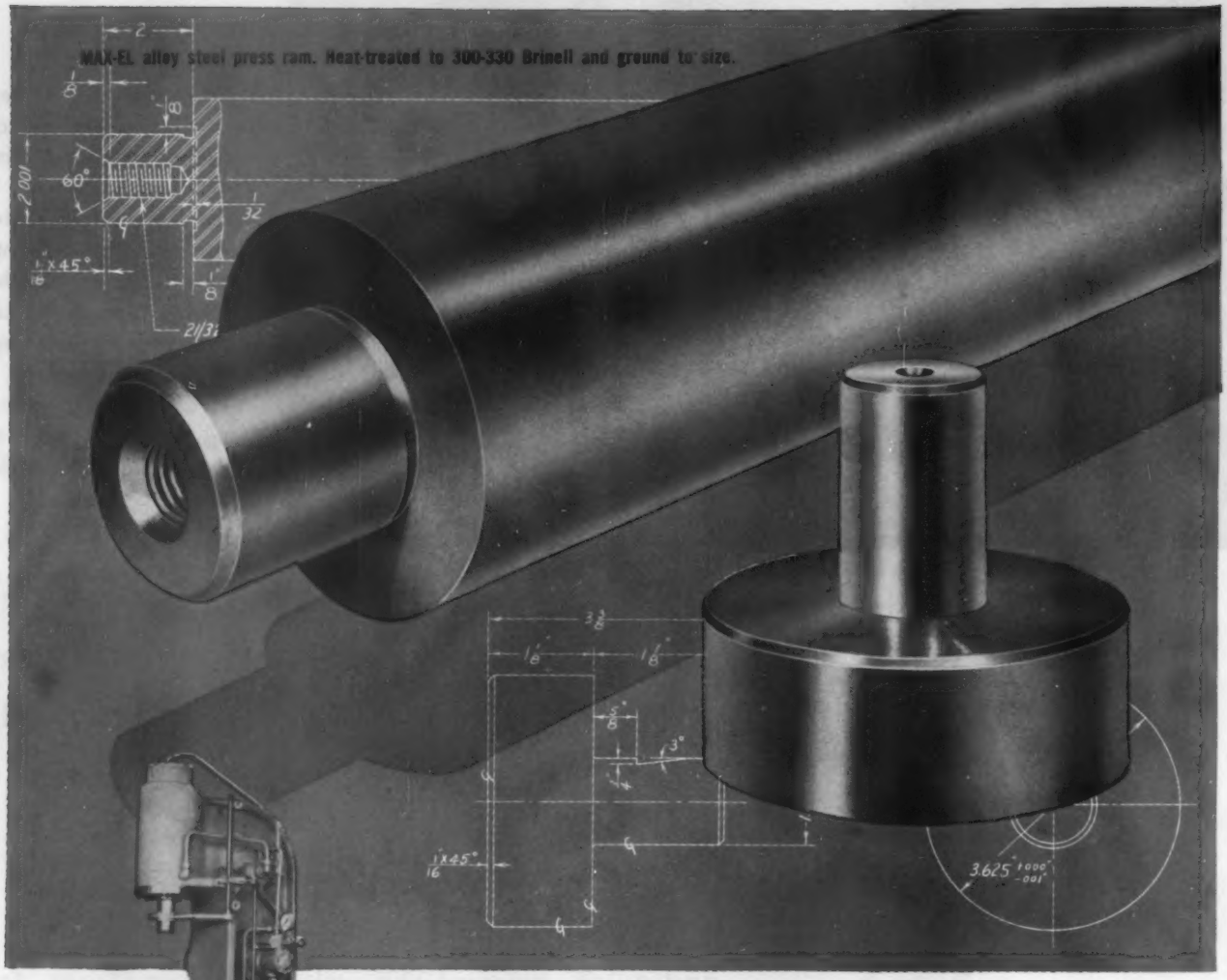
Machine operators know that the real test of a counterbore drive is how it stands up under the stresses imposed during large diameter cutting operations. And operations like these have been the proving ground for Continental Counterbores. In customers' plants Continental Drives and Cutters, regardless of size have demonstrated their extreme ruggedness. An added feature to save minutes: Each Continental Counterbore Holder accommodates a wide range of cutter sizes.

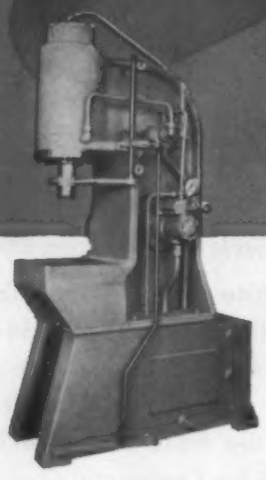
Continental Counterbore Sets are available in your choice of sizes. Each is fully described in Bulletin 60446. Write for your copy today.

Continental

TOOL WORKS
Division of Ex-Cell-O Corporation
Detroit 32, Michigan

55-37





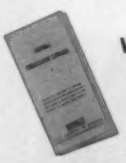
MAX-EL Alloy Steel means no distortion—longer wear in 15-ton hydraulic press ram

To keep this 15-ton press operating day after day for years of dependable service, takes *special* steels. For example, even after thousands of cycles of operation, the ram *must* remain accurately in line with the work table. *It demands a steel that will not distort, set or wear.*

That's why both the ram and ram-plug are made of Crucible MAX-EL alloy steel. In fact, the manufacturer, Greenerd Arbor Press Co., Nashua, N. H., has been a steady user of MAX-EL for many years.

Here's what they have to say—*"We have tried many grades of steel, but we find that MAX-EL 3½ heat-treated in the bar works out better for our application."*

And it probably will for yours, too. So when you have a job calling for a non-deforming alloy steel—one with excellent machinability, high-strength and wear-resistance—try Crucible MAX-EL. It's promptly available from your nearby Crucible warehouse, in the sizes and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*



Write for your free copy of this *Crucible Publication Catalog* listing dozens of helpful booklets and data sheets.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

ARMSTRONG

Quality TOOLS

More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

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Engineering experience makes the difference

Bath gages offer you a big advantage! Experienced engineering behind the planning and production of standard and custom built Bath gages, makes the difference between dollars wasted and saved!

This long established engineering service is an intangible . . . a feature you may never have appreciated as a valuable part of our organization — yet, a big factor in Bath gage quality, dependability and economical performance.

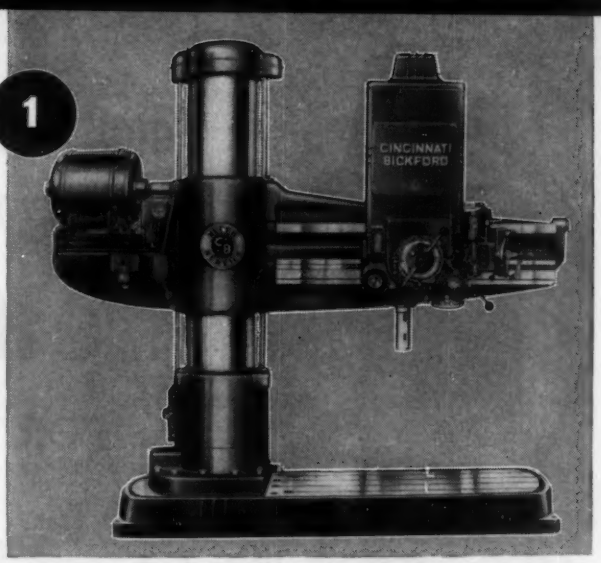
The best part of it is . . . this highly specialized service is always available to help you solve inspection problems . . . big or small. It's yours to use . . . send us the details!

A request on your business letterhead will bring your copy of the new Bath Tap and Gage Catalog.

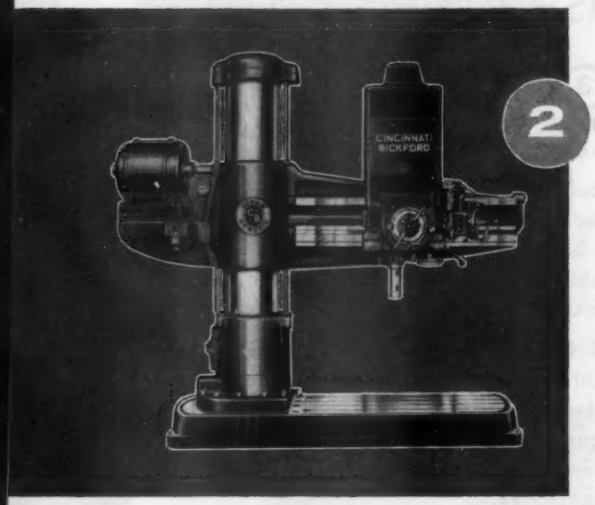
JOHN BATH & CO., Inc.

22 Grafton St., Worcester, Mass.

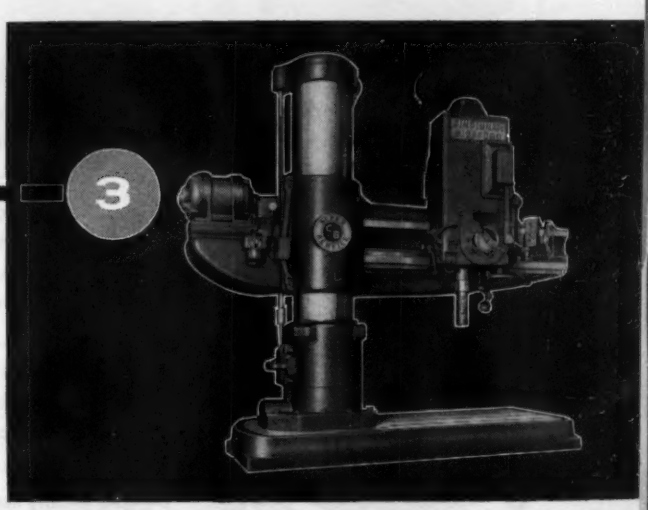
CYLINDRICAL PLUG AND RING GAGES • THREAD PLUG AND RING GAGES • THREAD MEASURING WIRES
MASTER SETTING DISCS • INTERNAL MICROMETERS • GROUND THREAD TAPS



New 100% hydraulic pre-selection of all 36 speeds and 18 feeds gives this line of Super-Service Radials maximum performance and ease of handling. A simple prescheduling device shows speeds and feeds to be used on each successive operation and provides a permanent record. Ask for Bulletin R-33.



Speed range pre-selector, in conjunction with one speed change lever controls selection of 36 speeds. This new line of Super-Service Radials is for heavy duty work where split-second savings are not so important. Bulletin R-32 gives details.



Super-Service Radials with lever shifts for all speed and feed changes are still preferred by many who know the dependable ruggedness of these machines. Write for Booklet R-29.

One of these 3 will do your job BEST---

You have a choice, in Super-Service Radials, as to the extent to which automatic gear shifting and preselection of speeds and feeds will be employed.

The highest development is shown at Fig. 1; but for many kinds of heavy duty work, the machine with speed range pre-selector and lever shifts for other changes, is to be preferred. Look at all three—by writing now for latest catalogs.

CINCINNATI
BICKFORD

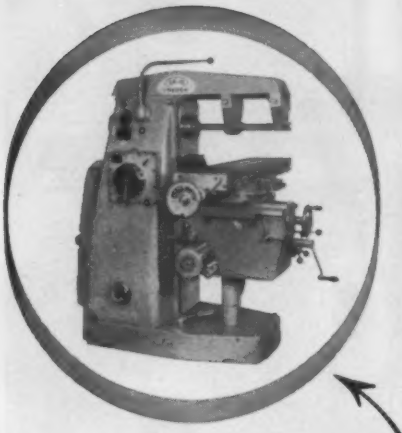
RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

Subsidiary of GIDDINGS & LEWIS MACHINE TOOL CO. : Fond Du Lac, Wisconsin.

Swedish Craftsmanship!



headquarters

FOR THE FINEST SWEDISH MACHINE TOOLS

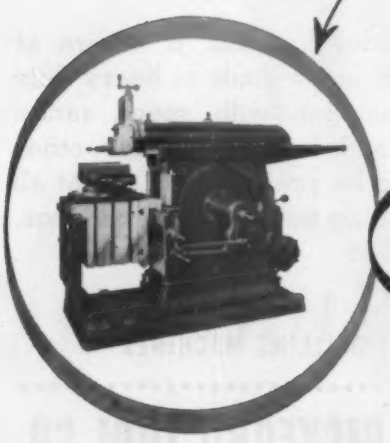
austin is American headquarters for the fine machine tools that are manufactured in the modern Swedish machine tool center of Värnamo.

Built with the painstaking workmanship and quality materials that characterize Swedish products, these machine tools, since their introduction in the U.S.A., have earned an enviable reputation for accuracy and dependability in toolroom and production line. All machines comply fully with U. S. Standards.

SAJO #2 ALL GEARED MILLING MACHINES — plain and universal models — light and standard types, all built to modern design to meet industry's demand for fast, simplified operation while maintaining maximum accuracy. Available with longitudinal power feed only or with power feed and rapid traverse in all directions. Offered with full line of accessories.

SAJO HYDRAULIC HACKSAWS — Utility and Production Models — 6" x 6", 9" x 9" and 10" x 10" capacities. These sturdy machines, for intermittent or production duty, have unique patented features and are attractively priced. Sajo Hacksaws represent exceptional values in cutting off equipment.

PREMA 13" SHAPER — a "mighty mite" — ideal for applications where large shapers are not justified. "Big Shaper" performance and accuracy at modest cost makes the Prema a profitable addition in the toolroom or on light production work.



VMA SHAPERS are available in both standard and heavy duty models — 14" to 26" length of stroke. These rugged amply powered machines provide speedy set-up, ease of operation and maximum stamina in the toolroom or production line. Automatic lubrication and table power rapid traverse are standard on heavy duty models. Universal table and other accessories are available.

Service and spare parts available from us or from our dealers in principal cities.

For complete details, illustrated catalogs and information as to reference installation in your vicinity write to

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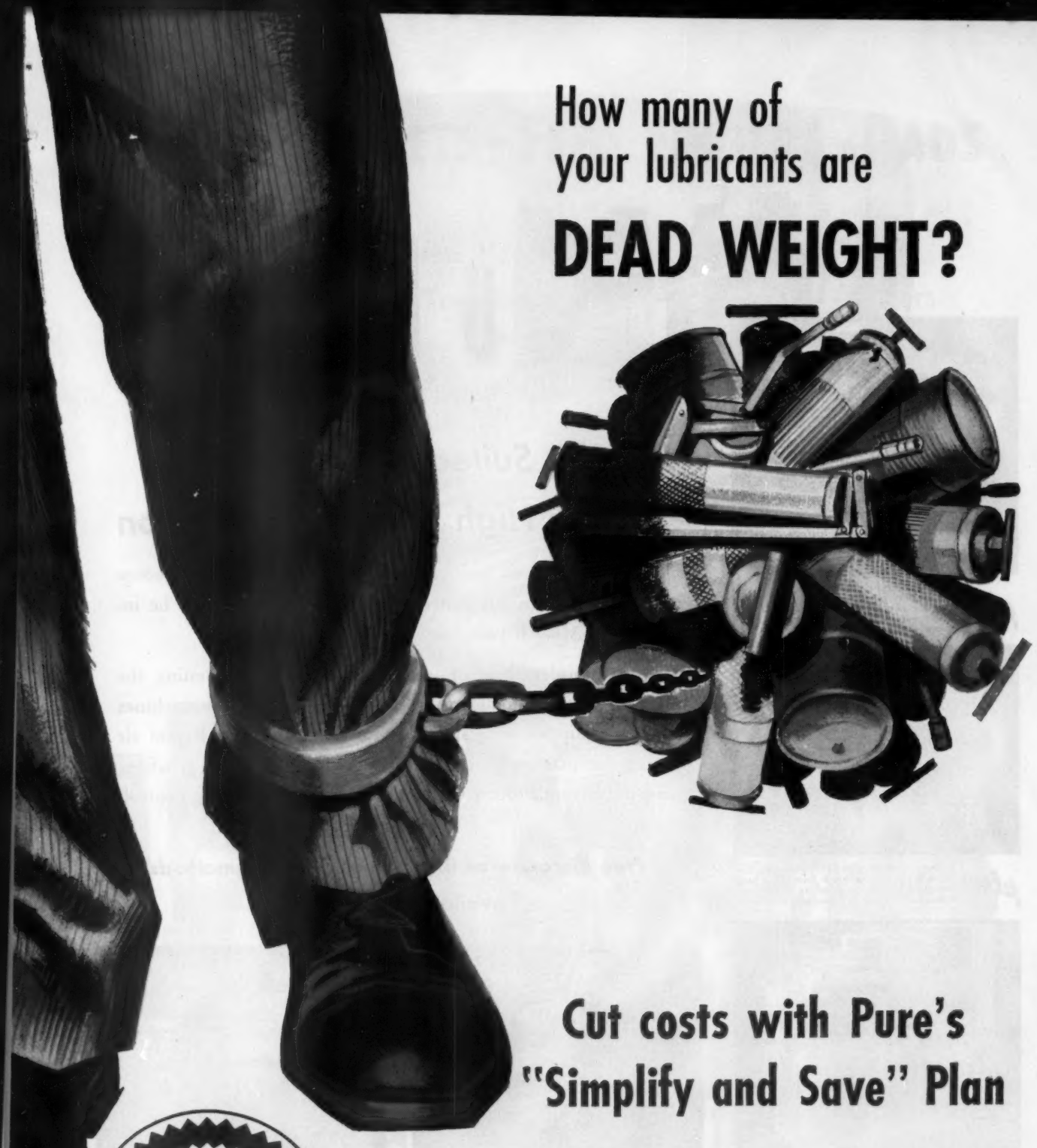
76-F MAMARONECK AVENUE, P. O. BOX 430, WHITE PLAINS, N. Y.

Look for the Austin Seal — your full guarantee of satisfaction.

How many of your lubricants are DEAD WEIGHT?



Cut costs with Pure's "Simplify and Save" Plan

BE SURE PURE WITH PURE

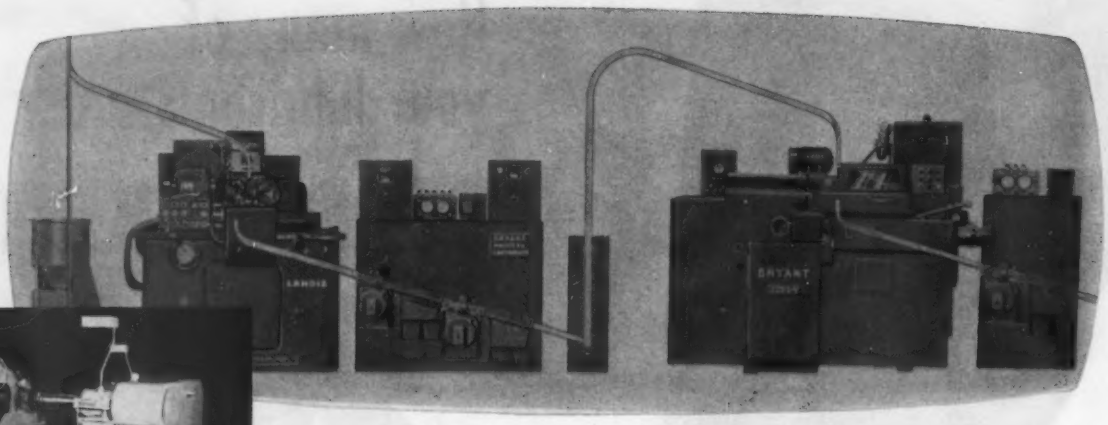
If your maintenance men are hampered by dozens of different oils and greases, here's how to speed their lubrication work and make big savings in man-hours.

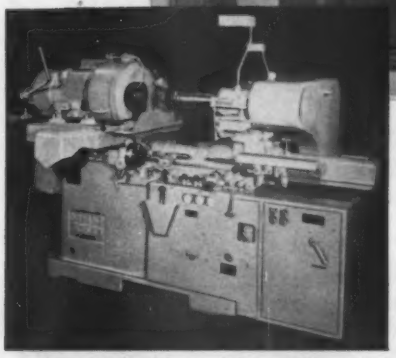
Pure Oil *multi-purpose* lubricants are the answer. In most plants no more than six of these money-saving, time-saving lubricants do the entire job. Makes lubrication *faster, surer, simpler.* Cuts costs right down the line from purchasing to application.

Find out how Pure's "Simplify and Save" Plan can cut costs in *your* plant. Reverse the charges to the nearest Pure Oil office today.

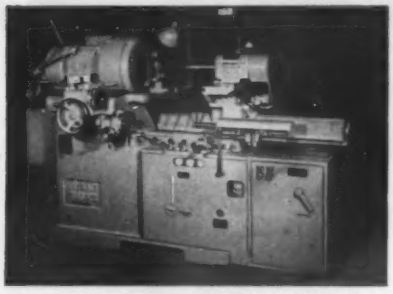
Be sure with Pure PURE MULTI-PURPOSE LUBRICANTS

Sales offices located in more than 500 cities in Pure's marketing area





plus *Combined bore and face grinding.* 1316-J Bryant performs two or more operations at a single chucking. Two wheelheads on a single wheelslide provide exceptional speed, accuracy and versatility.



plus *Extreme accuracy and fine finishes.* The 1116-X features an extra fine cross feed. Designed for ease in grinding to close tolerances of size, out of roundness and finish.

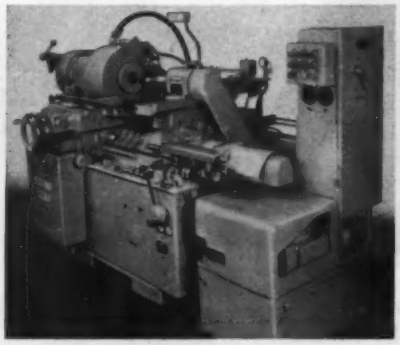
plus *Uniform fine finishes, utmost accuracy* and peak production on the Bryant 998 Precision Boring Machine . . . in precision boring, drilling, turning, facing, grooving, contour boring and turning.

Equally Suited to Toolroom or High Volume Production

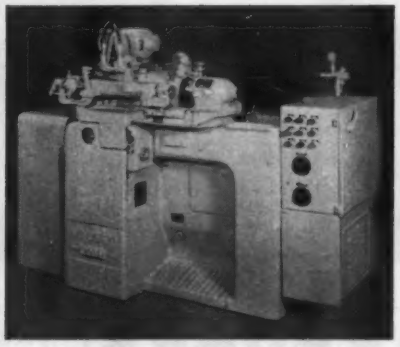
Whether your main interest lies primarily in tool room production, or in automated production lines, you will be interested in what Bryant has to offer.

A complete line of internal grinders, incorporating the exclusive Bryant alignment features, is available. These machines can be equipped with such cost-cutting features as Bryant air sizing, for extremely accurate sizing, shoe centerless grinding, and the Bryant Process Controller, for automatic sizing control.

Free literature on Bryant machines and methods available on request.



plus *Constant production in bore grinding.* The 3216 Bryant Automatic features automatic cycling for high production precision grinding.



plus *High production grinding of small bores.* Control of this Bryant 1209-Y with the Bryant Process Controller provides automatic statistical quality control.

BRYANT

chucking grinder co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

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CRI-DAN E

FOR EXCELLENCE in all Threading Operations

Presenting the "E"

...a heavier, huskier, hydraulically controlled CRI-DAN

It's Here—At Your Request. Yes, the tremendous acceptance of Cri-Dan "B" and Cri-Dan "D" has resulted in the development of a larger, heavier precision threading machine greatly extending the range of the Cri-Dan Single Point Threading Method. Not only precision threading but secondary turning, boring, facing and chamfering facilities are incorporated in the Cri-Dan E; complete hydraulic and electric controls assure maximum efficiency even on the heaviest applications. A quick check of the specifications will show the ruggedness and range of this, the newest and finest Cri-Dan Single Point High Speed Threading Machine ever developed. Write The Lees-Bradner Company, Cri-Dan Division for specific information on the processing of your parts.

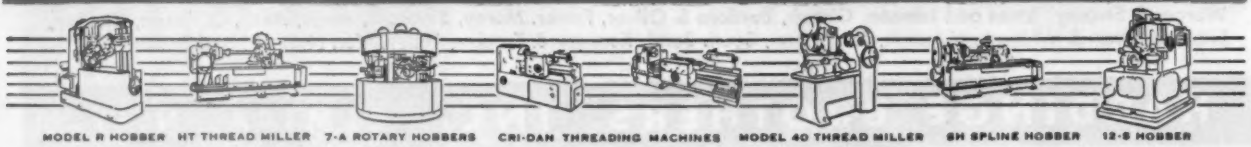
SPECIFICATIONS

Threading Range	2 TPI-48 TPI	Max. Taper of Thds.	15° Included
Max. Thd. Dia. (Internal)	16" Dia.	Multi-Start Threads	Yes
Max. Thd. Dia. (External)	12" Dia.	Spindle Speeds	50-1400 RPM
Max. Swing Over Ways	25" Dia.	Main Motor	20 H.P.
Max. Swing Over Tool Slide	12" Dia.	Floor Space Req'd	5'6" x 14'0"
Max. Thread Length	6½"	Approx. Weight	4½ Tons
Length Between Centers	2'6", 5'6" & 8'6"		

CRI-DAN DIVISION

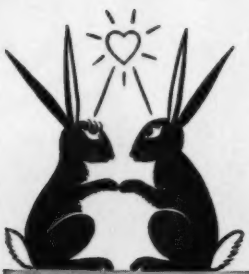
the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER HT THREAD MILLER 7-A ROTARY HOBBERS CRI-DAN THREADING MACHINES MODEL 40 THREAD MILLER 8H SPLINE HOBBER 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER



...corner high production

SEE YOUR

Threadwell

DISTRIBUTOR

FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.

B-52 wings get a lift

This huge press, installed at Boeing-Wichita where it produces inner skins, wing stiffeners and similar components for the B-52, has *three* features that are proving a boon to cost-conscious Boeing engineers and taxpayers alike:

- Its tremendous power allows Boeing to *heat-treat parts prior to forming*—giving them the added strength they need.
- The rubber pad slashes tooling time and costs—a significant advantage in short-run production.
- The two die slides boost output: while one is in the press, the other is loaded.

Like *all* Bliss Hydro-Dynamics, regardless of size, this press is fast starting, quick on the approach and return (300″ per minute). Its controls are simple, and operation foolproof.

If you believe that a hydraulic press may solve your production needs, let a representative give you the benefit of Bliss' experience. Since Bliss manufactures a complete line of hydraulic *and* mechanical presses, you can be sure of an impartial recommendation—a recommendation that results in the one *right* press for the job.

STRESSES HERE ...ARE OVERCOME HERE

BLISS
SINCE 1857

is more than a name...it's a guarantee!

E. W. BLISS COMPANY, Canton, Ohio
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

with a 7000-TON "SQUEEZE"

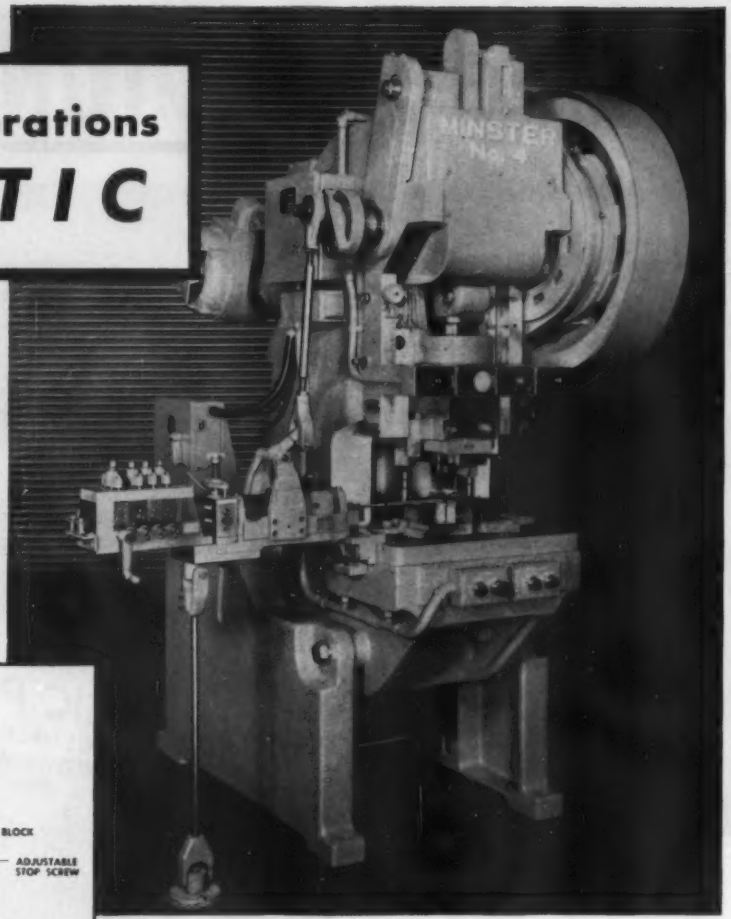
7000 TON CAPACITY BLISS
HYDRAULIC PRESS
ALMOST THREE TIMES THE CAPACITY OF THE BIGGEST HYDRO PRESS USED FOR THE B-29
WILL FORM LARGE METAL PRODUCTION PARTS FOR B-47'S AND B-52'S
WEIGHT 500 TONS
INSTALLED COST COMPLETE !! $499,790
BLISS

TWO STORIES HIGH, this press is essentially a single action press of open-rod "moving down" construction, with the slide guided on all four rods. Despite its mass, however, it can be precisely controlled: the operator can inch the slide to the work and stop it at any point in the stroke.

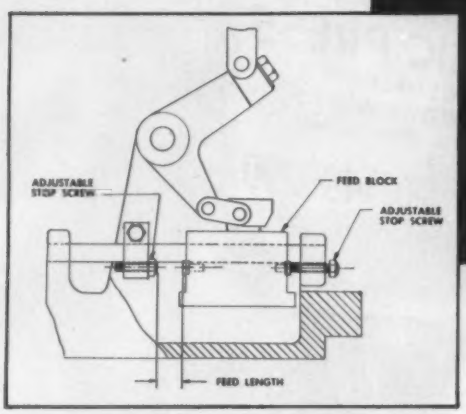
U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa. Branch Offices in Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

Send for Catalog

Make Your Press Operations AUTOMATIC



The photo at the right shows an SF-1 U. S. Slide Feed with SS-07 U. S. Plain Stock Straightener (7-roll type) mounted on a No. 4 Minster Press which is equipped with an air clutch and variable speed drive.



The drawing at the left shows how feed length is controlled between positive adjustable stops on the U. S. Slide Feed. This feature assures controlled accuracy of feed length—an especially important factor in progressive die operations.

Cost reduction is of the utmost importance to you. One means of achieving this is through automatic operation. U. S. Slide Feeds are designed and built primarily for the automatic feeding of coil stock into punch presses. By using a U. S. Slide Feed with a Straightener and a Stock Reel or Coil Cradle you can convert your presses into automatic machines.

The use of this equipment gives you the double advantage of increased production and reduced labor costs, plus the feature of flexibility. Within their capacity, U. S. Slide Feeds can be easily adapted to handle materials varying in width, thickness and length of feed. Furthermore, U. S. Slide Feeds are designed so that the length of feed is controlled between positive stops as shown in the drawing, providing consistent accuracy that is especially desirable in progressive die operations.

We are sure that you want to reduce costs and speed output in your press operations. We suggest that you investigate the many advantages of U. S. Automatic Press Room Equipment. Bulletin 80-A gives complete specifications. Ask for your copy.

U. S. TOOL COMPANY, Inc.

Ampere (East Orange) **New Jersey**

Builders of U. S. Multi-Slides—U. S. Multi-Millers
U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

How to make your plant sound as a bell...

...SWITCH TO CIMCOOL®, the radically new and different cutting fluid that has become, in just a few years, the largest selling chemical cutting fluid in the world.

As the good news about CIMCOOL Concentrate rings out across the land, sales are continuing to climb. Here are just two of the many outstanding advantages that CIMCOOL has over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We know CIMCOOL will ring the bell in your plant, and we'll be happy to tell you why—with an explanation of the many specific advantages of CIMCOOL Concentrate. We will also provide details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll send one of our Cincinnati Milling-trained machinists—without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

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CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Base Additive — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL Bactericide — The most effective agent yet developed to overcome rancidity.

CIMCOOL Machine Cleaner — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

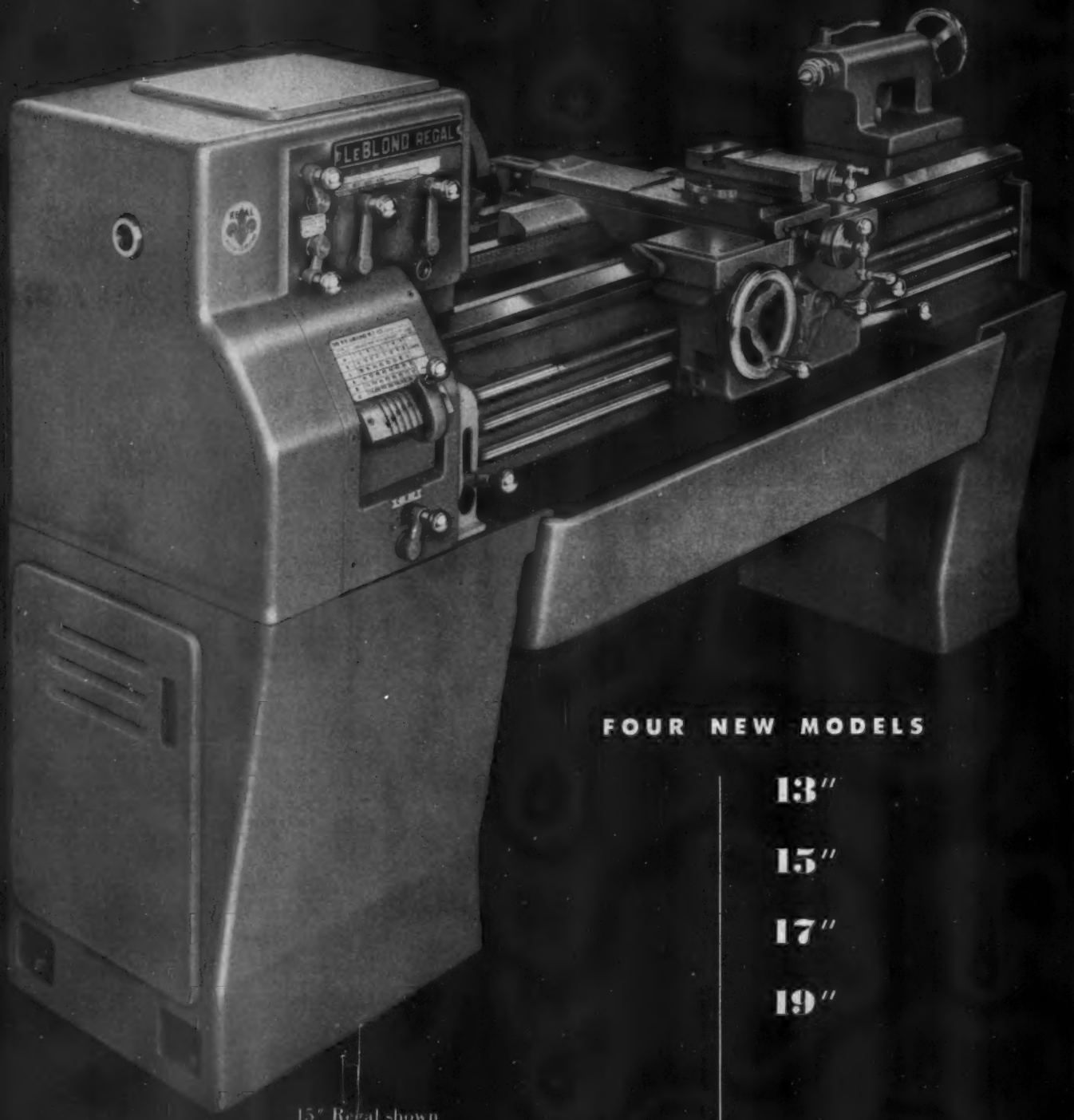
CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

cut with confidence . . .

HERE'S THE



15" Regal shown

FOUR NEW MODELS

13"

15"

17"

19"

NEW LeBLOND REGAL

The only lathe in its class with so many big-lathe features

Designed and built like heavy-duty lathes, the new LeBlond Regals will give you long life of precision production, minimum maintenance and the kind of dependability you'd expect from a much higher-priced machine!

Consider, for example, the new Regal headstock. It uses the same combination gear-belt drive construction that proved itself on the famous LeBlond Dual-Drive and is now incorporated on our new 16" heavy-duty lathe. Then take a look at the new bed with hardened and ground replaceable steel ways. Like the ways on our heavy-duty machines, they are fitted according to the compensating veeway principle to insure better distribution of forces for proven long-time accuracy and minimum wear.

Again, like higher-priced lathes, Regals are equipped with *both* feed rod and leadscrew for continued accuracy in thread chasing. Other big-lathe features—3-bearing spindle. Automatically lubricated quick-change box. Wide carriage bridge with ample bearing surface. Rugged tailstock with plug clamping. Plus general dimensions and construction details patterned after LeBlond heavy-duty lathes.

Only from the builder of a complete line of lathes can you get a low-priced lathe with true big-lathe features. All of LeBlond's 68 years of experience has gone into the design and building of these new Regals. Be sure you get all the details; see your LeBlond Distributor or write for Bulletin R-200-A.

	13"	15"	17"	19"
Swing over bed and carriage wings	14"	15½"	17¼"	19¼"
Spindle speeds, number	12	12	12	12
Spindle speed range, rpm.	45 to 1800	30 to 1200	38 to 1500	25 to 1000
Feeds and threads, number	48	48	48	48
Feed, range, in. per rev.	.0018—.106		.002—.116	
Threads per inch, range	4—224		2—112	
Horsepower	2	3	3	5

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • FOR MORE THAN 68 YEARS

FLEXLOC AT WORK

Power Hack Saw Builder Fastens blade guides with FLEXLOC self-locking nuts. Eight of these one-piece, all-metal locknuts are used in this assembly. And they won't work loose, regardless of vibration.

You can get the same dependable service. FLEXLOCs come in a wide range of sizes, types and materials. They are stocked by leading industrial distributors everywhere. Ask your local man for Bulletin 866. Or write STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

• • •

Use FLEXLOCs anywhere:

ON ROUGH BOLTS. FLEXLOCs smooth out bolt threads without damaging their own threads.

IN TEMPERATURES TO 550° F. in plated nuts and even higher in unplated ones. High temperatures do not affect FLEXLOCs. Nuts with non-metallic inserts fail under such conditions.

AS LOCK OR STOP NUTS. After at least 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC stays put.

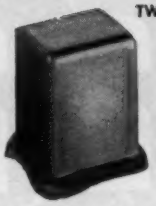
REGARDLESS OF MOISTURE, OIL, DIRT AND GRIT. Even conditions like these do not affect the locking ability of FLEXLOCs.

FLEXLOC®
LOCKNUT DIVISION
SPS
JENKINTOWN PENNSYLVANIA

TWO OPERATIONS
Container of 18 gage 2SO aluminum formed by redrawing a larger cup. Part size: 2½" dia. x 4⅝" deep.

TWO OPERATIONS
Relay Cover of 0.025" 2SO aluminum formed by redrawing a round cup into the final shape. Part size: 1¾" x 2⅛" x 3⅞" deep, with ⅛" corner radius.

ONE OPERATION
Cover of 0.037" deep drawing steel. Size: 1⅝" x 2⅜" x 2⅜" deep, with ¼" corner radius.



TWO OPERATIONS
Cover of 20 gage 2SO aluminum formed by redrawing. Part size: 1⅜" x 1⅞" x 2¼" deep, with 3/32" corner radius.

Shown above are typical parts produced by F. & B. Mfg. Co.'s Cincinnati 8" Hydroform. Shown at lower right are other interesting examples of 8" Hydroform work.

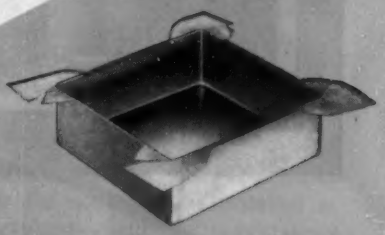
Cincinnati 8" Hydroform Brings New Economies To F.&B.

Equipped with the Cincinnati 8" Hydroform shown at right, F. & B. Mfg. Co., Chicago, Illinois, is producing deep drawn parts at costs substantially lower than previously possible using conventional presses. Manufacturers of *Filco* Automotive Ignition Equipment, and contract suppliers of drawn parts, F. & B. gives credit to the 8" Hydroform for greatly increasing the versatility and *economy* of their production. Now, formerly difficult short-run jobs are handled with ease, and experimental work is readily completed—all with exceptional time and tool cost savings.

If you do deep drawing, or can convert a portion of your component part production to drawn shapes, you can receive the same benefits from Hydroforming now enjoyed by F. & B. Let a Cincinnati Milling field engineer give you full details. New Bulletin M-1908—completely revised—gives a detailed description of Hydroforming and specifications of the 8", 12", 19", 23", 26" and 32" machine sizes. Write for your copy.

8" HYDROFORM
Max. draw depth, 5".

ONE OPERATION
Diaphragm of 0.005" stainless steel, 1⅜" dia. Extremely close tolerances held on part contours.

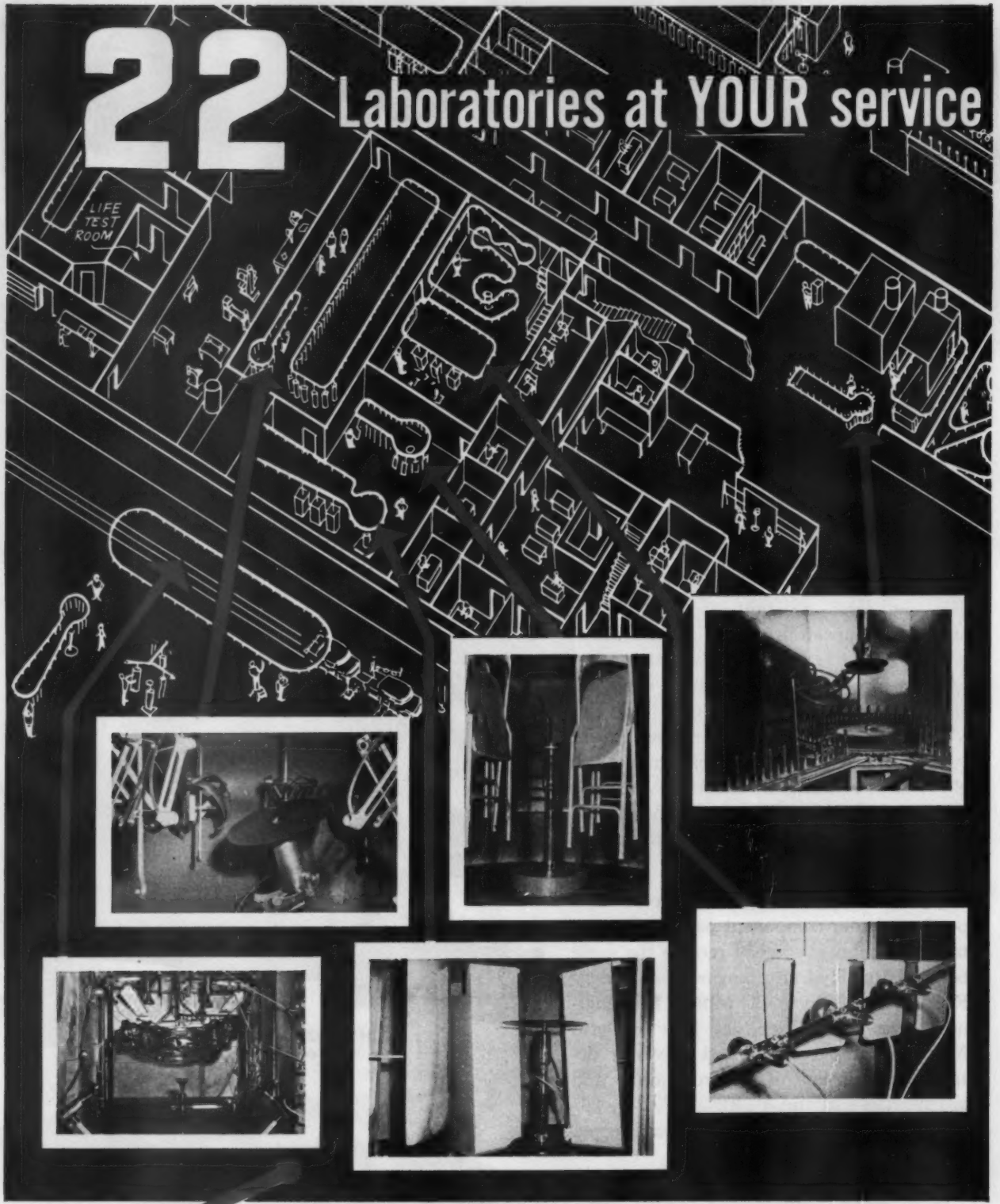


ONE OPERATION
Box of 0.010" 2S full hard aluminum. Part size: 2" square x ⅝" deep, with 0.030" corner radius.

CINCINNATI **Hydroform**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

22 Laboratories at YOUR service



YOUR JOB, LIKE THESE SHOWN ABOVE, WILL BE TEST PROVEN

under simulated production conditions to determine cost-saving benefits and other advantages. Ransburg also maintains other test facilities in Los Angeles, London, England; Bad Hersfeld, Germany; Paris, France and Sydney, Australia.

to prove the painting of YOUR products with

RANSBURG

Electrostatic Painting Processes

Let us make laboratory tests and prove the advantages and cost-saving benefits of painting YOUR products AUTOMATICALLY with one of the Ransburg Electro-Spray Processes.

GET THE FACTS . . . IT COSTS YOU NOTHING!

STEP BY STEP—HERE'S WHAT YOU GET...

- Survey of your plant by Ransburg's experienced field engineers, including savings estimate.
- Lab painting demonstration of your products, using equipment closely simulating your own production conditions.
- Accurate measurements of paint film thickness.
- Engineering report of detailed tests to determine paint and labor savings.
- Coated samples of your job, lab production photos, and even movies if desired.
- Detailed drawings of equipment and workholder.

All of the above without obligation to you. And, before equipment is installed you receive detailed, pre-installation instructions. Too, a well-qualified, experienced engineer supervises installation and trains your operator on the job. Ransburg offers continuing laboratory and field service to help you with any of your finishing operations.

Ransburg

ELECTRO-COATING CORP.
Indianapolis 7, Indiana

● **First,** Ransburg sales engineers will make a survey in your plant to check the possibilities of using Electrostatic Spray Painting on your products. Next, you will send samples of your unpainted products—with paint—to the Ransburg laboratories in Indianapolis.

Here, the technical staff takes over. The Ransburg Engineering staff—which includes PH.D's and Masters in Physics, Science, Electrical, Mechanical and Chemical Engineering—makes a complete study of your job. Not only do they have the necessary academic training, but they have the "know how" gained from years of actual experience in the field. Ransburg, you know, was the pioneer in Electrostatic Spray Painting 15 years ago. Engineers and well-qualified technicians have at their disposal every facility for conducting complete tests, simulating your own production conditions. They'll decide which type conveyor is best suited for your job. (There's a conveyorized lab set-up—22 in all—to handle products ranging in size from automobile bodies and chassis to small components, such as window hardware.) They'll design workholders, if necessary, and determine exactly how your job can be run to your best advantage. Details, such as fixture spacing, will be worked out too.

After preliminary studies and tests, you are invited to Indianapolis to see your job run in the lab. If you wish, photos and even movies of your test run can be made and furnished for your own production people to study. You see first-hand what Ransburg Electrostatic Spray Painting can do for you in your own plant.

YOU GET PAINT AND LABOR SAVINGS

Paint usage is accurately measured during the demonstration. The Ransburg No. 2 Process will provide savings up to five times the paint mileage of hand spray. And, one unit can do the work of many hand sprayers. You will see the improved, uniform quality of the work . . . you'll know what kind of increased production to expect, and you can recognize labor savings. ALL OF THIS WITHOUT OBLIGATION.

Ransburg service doesn't end there. After the equipment is installed in your plant—with our supervisory help—we will train your operator and continue to work with your finishing department. Our technically-trained field service engineers are always available to assist with any of your finishing problems.

Briefly, that's our story. Now it's your move. Call or write. Dept. AM

for AUTOMATION
...your cutting tools MUST be kept Sharp and Accurate
—equip with an OLIVER "Automatic" Face Mill Grinder

Automation CAN bog down if your cutters are not kept sharp and accurate. The thrifty Oliver is simple to operate (one man can easily run several machines at a time) . . . yet it grinds a greater number of accurately-ground milling cutters per hour than ordinary face mill grinders.

The efficient Oliver automatically indexes and machine grinds each tooth in succession until the entire cutter is completely and accurately ground. The shape of the tooth is determined by inexpensive, easily replaceable, hardened cams.

The lasting accuracy of the OLIVER "AUTOMATIC" FACE MILL GRINDER is assured . . . at each stroke the wheel passes over a fixed diamond compensating for wheel wear. This unique Oliver feature enables tungsten-carbide and high speed inserts to be easily and rapidly ground to any degree of accuracy and quality of finish.

We'll be glad to tell you more—just write, wire or phone.

OLIVER INSTRUMENT CO.
1414 E. MAUMEE • ADRIAN, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

We're Sorry

In our article on automatic gear production (AM—Aug 1 '55, p113) *we mentioned a Rota-lift conveyor for handling blanks from a hopper to an inspection unit. The manufacturer of this unit, Counsel Machine Co, Wallington, NJ, advises us that the correct name is Robo-Lift. We apologize for the error in spelling.* —Ed.

Wrong Spelling

I recevied your letter with the cut-out sheet in which you printed my idea on impression compound (*AM*—Sept 12 '55, p160). You did a very good job in presenting this article. However, I am very disappointed in the misspelling of my name. I hope that in the next issue of your magazine you will mention this typographical error and spell my name properly.

The sweetest music to a man's ear is his name.

Fred H Lingenfelder
Milwaukee

New Wine

Your article on the new Ansco camera (*AM*—Sept 26 '55, p137) was particularly noteworthy, not because of the manufacturing detail, although that was extremely interesting, but because of the lesson it teaches. Every design engineer should be compelled to read it at least twice.

Of course, Ansco is up against some pretty tough competition, but they must have some pretty smart people to have so quickly learned that it does not pay to put new wine in old skins. They have faced squarely up to the problem that causes process engineers to get more gray hairs than any other.

It happens so often that the design dep't will come out with a new or redesigned model—of any product—that may be positively brilliant in conception but which they want to have produced with little or no tooling cost. They'll smile blandly and say, "Oh, we've only added a couple of holes here, and changed that radius from a quarter to an eighth, and, oh yes, we've added a couple of little ribs over there. That shouldn't mean much of a die change."

They overlook the fact that there's no room in the punch holder for

GRINETICS

By D G SMITH

MEASURING WIRES

FORGING EQUIPMENT

CLOCKWISE

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for
W. H. NICHOLS Company

Precision holes ⊕ Mass produced by LELAND-GIFFORD DRILLING MACHINES

Producers of high speed, high precision metering and gerotor pumps . . . manufacturers of one of the most precise milling machines ever made — W. H. Nichols Company has a world-famous reputation for the quality of its work and the excellence of its production facilities.

For the many precisely located, exactly sized, and precision drilled holes involved in its operations, W. H. Nichols Company relies on the built-in accuracy of Leland-Gifford Multiple Spindle Drilling Machines. The flexibility of multiple spindles, the convenience of centralized controls, plus the Leland-Gifford indicating shift for instant, accurate speed changes . . . all contribute to fast, error-proof handling of precision work.

If you have a drilling problem — or want bulletins on the newest Leland-Gifford Drilling Machines, call the office nearest you.

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3-Dimensional panto-miller

For accurate pantograph milling on all 3-dimensional work, the "Panto-Miller" 3A is a sturdy production machine. Accurately reproduces copy on flat or curved surfaces, in reduced or magnified size.

NEW:

Capacity for workpiece height.
Sensitivity of linkage.
Range of pantograph ratios.
Accuracy of reproduction.
Finger-Tip Control of spindle speeds.
Ease of operation.

The new Panto-Miller 3A is an economical answer to many standard and special production problems. Write for Bulletin PM3, which gives details and specifications.

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Versatile and dependable for continuous service, the J & B "Panto-Miller" 2A:

Engraves
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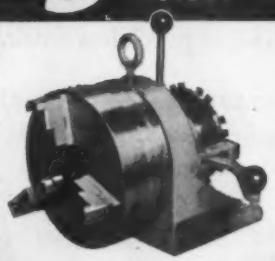
Mills

Investigate its advantages for your own applications. Send for Bulletin PM2

3-WAY Indexing Trunnion



Simple, Rapid, Positive positioning of workpiece or jig for all angle Drilling, Tapping, or Counterboring. Available with Chuck, Faceplate, or Right-Angle Adaptor Plate. Complete with Station Selector. For details, ask for Bulletin IT3.

J&B EST. 1870

JOHNSON & BASSETT, INC.

PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

those two extra punches, and that the radius change will mean a completely new die and may even change the draw characteristics of the metal, and that the "couple of little ribs" mean an extra operation.

Even in the best of plants, tools and methods become obsolete, but we continue to use them because they're what we've got, and the job is set up that way. But when a new job comes along it almost always pays off to scrap the whole lot and start again from scratch with the newest and best tools.

Wm Kittel
Philadelphia

No Signposts!

This is a belated letter to tell you that I feel the article you did on the Naugatuck River flood (*AM*—Sept 12 '55, p170) was the best coverage of this calamity. I think Messrs Stocker and Sheets should be congratulated on the excellent job they did. About the only mistake in it was a minor one—putting Winsted in the Naugatuck valley. Winsted is on the Mad River, which empties into the West Branch of the Farmington River. This fact did not make the amount of water in Winsted any less.

Thomas I S Boak
President, Plume & Atwood Mfg Co
Thomaston, Conn

With the main roads from Torrington out, and most people telling us that entry into Winsted was impossible, we did find a back way over the hill. It appears that our geography got a bit mixed up in the process. A lack of road signs didn't help, but we assure our readers that this unfortunate town still stands where it did, on the banks of the mad Mad

River. Excuse us, please. It was our first flood.—Ed.

Training Wanted

We have read several articles in your magazine concerning apprentice training as a machinist. My son has had a few months of machinist training in the army and is now in France in the maintenance department. He has worked for Florida Machine Products for a year and is very anxious to become a skilled machinist.

He has written to Brown & Sharpe, Providence, R.I., and likes the kind of training they offer very much, but would like to be nearer home. If possible, please send a list of places where he could get good apprenticeship training as a machinist.

D. Mallory
St Petersburg, Fla

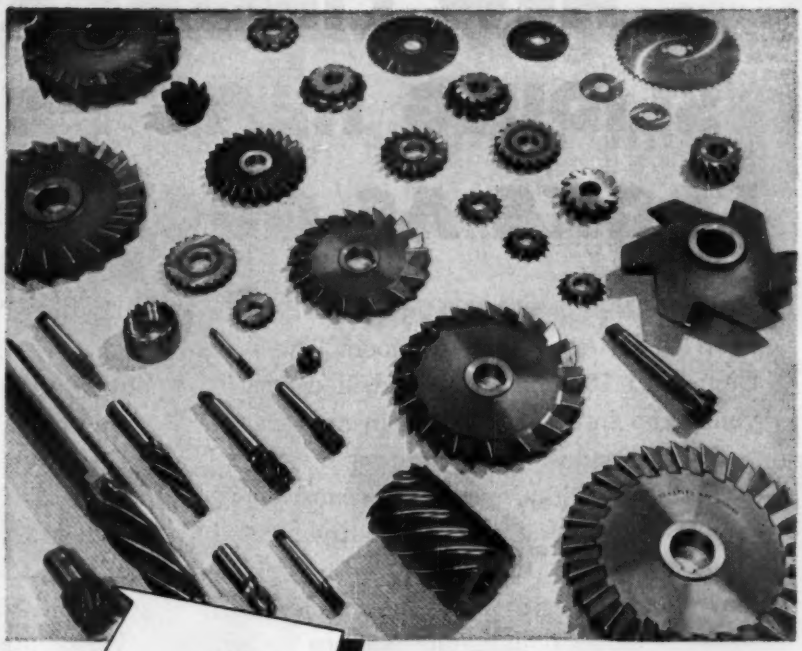
We are always interested to hear of young men who are anxious to undertake a machinist apprenticeship course, but we fear we cannot supply the list requested. The best source of information of this kind is the Bureau of Apprenticeship, Department of Labor, Washington, DC. Another source would be the National Tool & Die Makers Association, 907 Public Square Bldg, Cleveland, Ohio.—Ed.

We Move Forward

Having attended practically all the Machine Tool Exhibitions over the past 50 years, I feel safe in saying that the recent show in Chicago had more new and interesting features than any of the others. Your presentation of the special points of various machines was of particular interest. Perhaps the most striking feature to me was that, for the first time, the machine has outdistanced the cutting tools and is waiting for them to catch up. Always before, new tool materials have been developed first, and machines have had to be redesigned to give the power and speed to take advantage of the cutting ability of the new tools. But now, some machines at least must wait for new cutting materials to utilize the power and stamina built into them.

We are not yet at the end of the line. It is inevitable that in the near future these tools will appear to permit us to go to cutting speeds higher than we have yet seen.

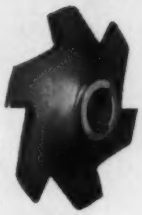
Fred H Colvin
Point Pleasant, NJ



THE *Complete Line*

GORHAM

END MILLS AND MILLING CUTTERS



For profitable solutions to production milling problems, call on Gorham! Over thirty years' experience in creating fine cutting tools is your assurance of satisfaction.

An extensive line of *standard* end mills and milling cutters is stocked by Gorham distributors. When you need *special* tooling, a Gorham Field Engineer surveys your problem and makes design recommendations for a tool to be "tailor-made" for your application by skilled Gorham craftsmen.

Ask your distributor for Gorham "standards." For "specials," call in your nearby Gorham Field Engineer. They're both well qualified to help you . . . and backed by unmatched experience and facilities. For profitable solutions to milling problems, call on Gorham! There's no obligation.

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

NEW CINCINNATI 16″ SLIDING HEAD DRILL THAT LOOKS AS GOOD AS IT RUNS

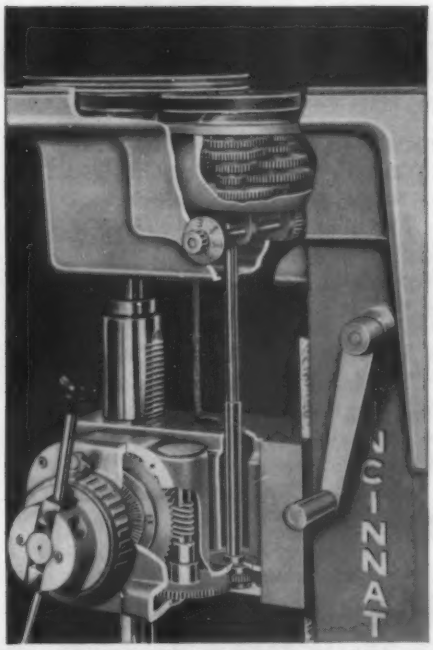
Here is in-the-metal-proof that a drill doesn't have to be homely to be good. The new Cincinnati 16″ sliding head drill can turn your shop into a showroom in appearance and performance.

Operators like this new drill because every important element is conveniently located and built in . . . power take-off, gearbox, feed selector, positive jaw clutch, electrical controls, depth dial, counterbalance spring, contour-fitting belt guard.

Best of all, this new drill can be equipped with power feed at slight additional cost . . . bringing the production advantages of automatic operation within the budget of any shop. Every drill is built to real machine tool standards of accuracy, and tested before shipment. A record of these tests is kept for permanent reference at CL&T. Bench, floor, and multi-spindle models available *now*.

Write for catalog D-138 and name of your local dealer. Cincinnati Lathe and Tool Company, 3250 Disney, Cincinnati 9, Ohio.

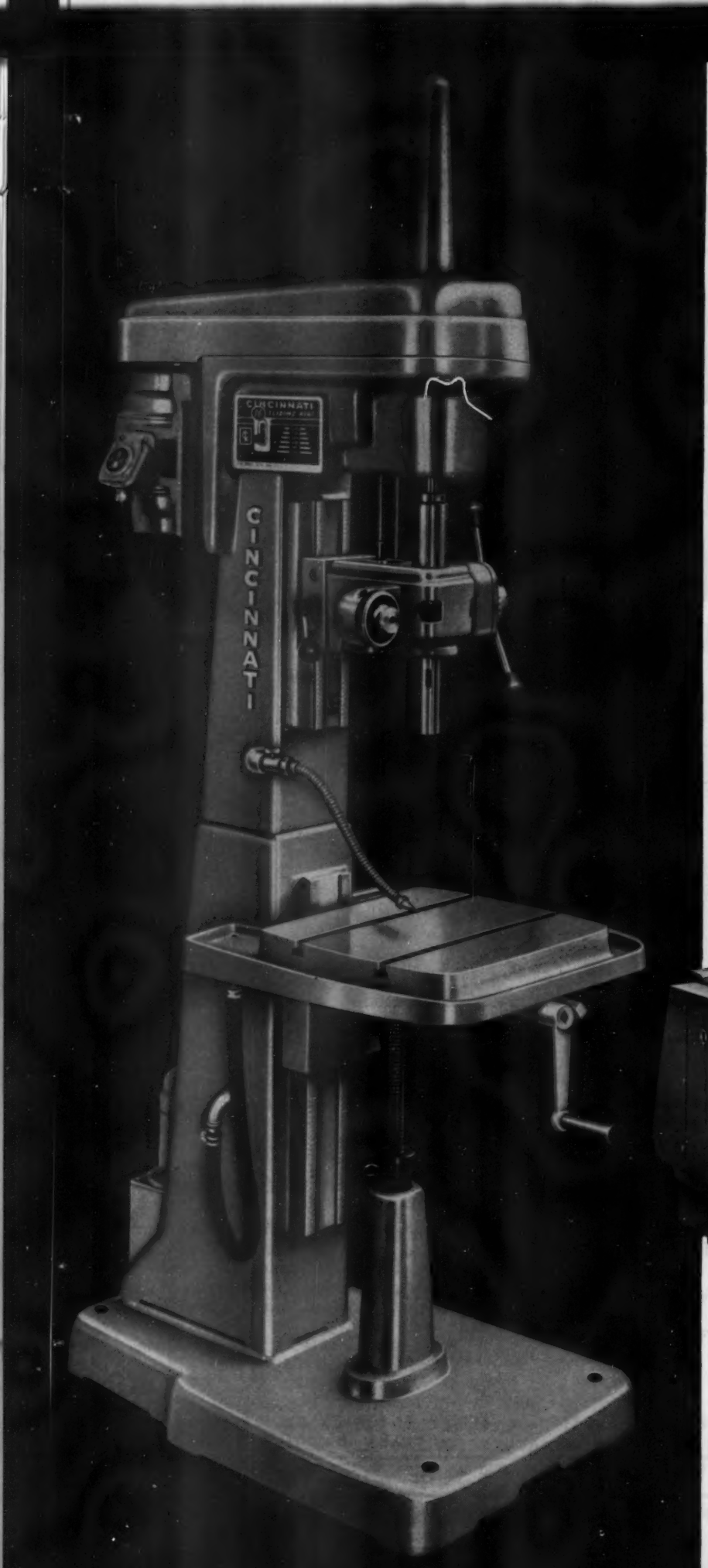
CINCINNATI LATHES and DRILLS



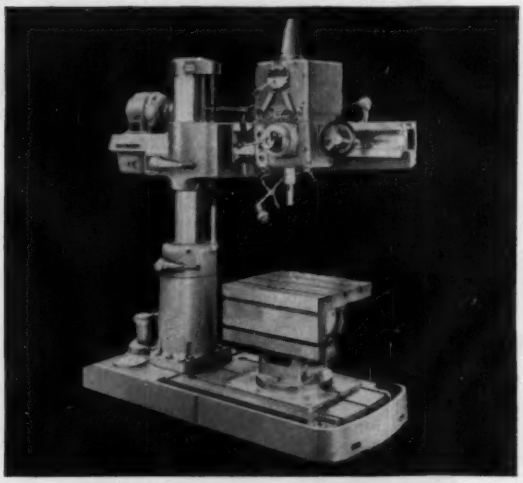
NEW GEARED POWER FEED—Positive jaw clutch engages four power feeds—.002″, .005″, .009″ and .015″ per spindle revolution. Automatic disengage for identical operations. Unit construction.

NEW ELECTRICAL CONTROLS—Built right into the head. All drills are shipped *complete* with motors and controls—no installation delays, just connect your power leads, and switch on the motor.

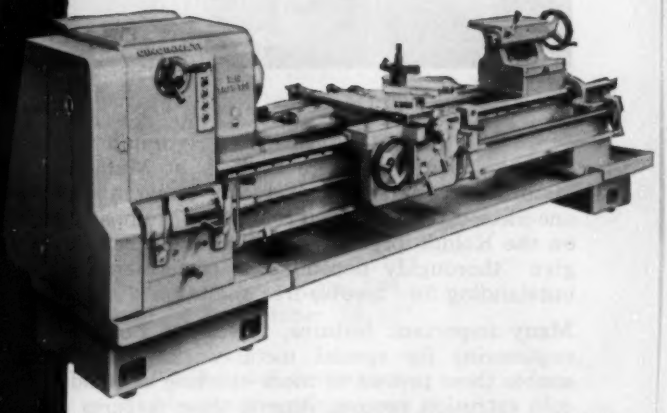
NEW FULL-FLOATING SPINDLE—All this spindle takes is torque! Four precision, sealed, lifetime lubricated bearings (two on spindle and two on pulley) take radial and thrust loads. Six spindle speeds. No. 2 Morse taper is standard; No. 3 Morse taper optional.



SEE THESE OTHER BRAND-NEW CINCINNATI TOOLS



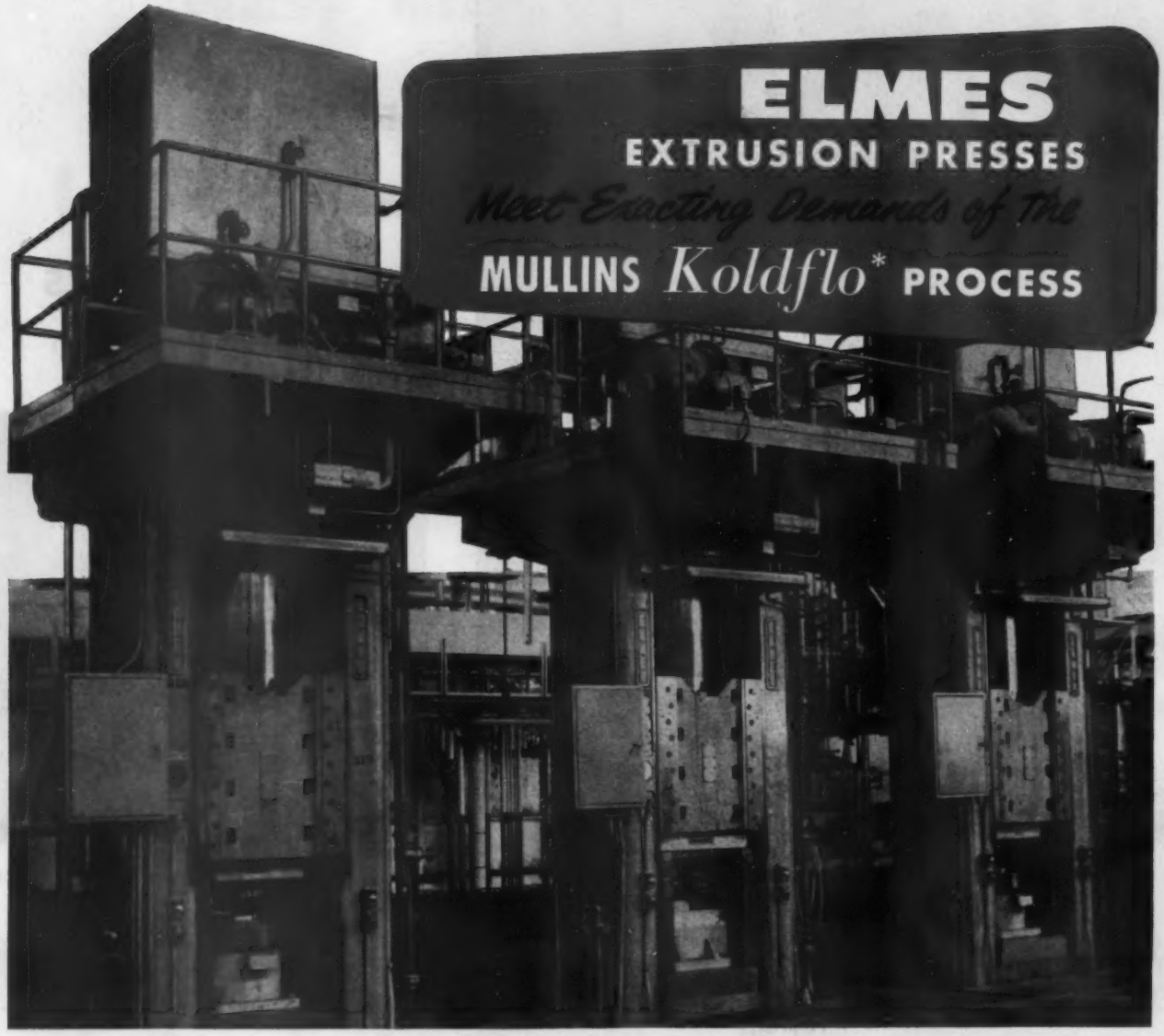
3′ 7½″ Radial Drills with Hard Clad Columns.



10″, 12½″, 15″, 18″, 21½″ and 26″ Tray-Top Engine, Toolroom and Fixed Gap Bed Lathes with Hard Clad Bedways.

center on . . .

cincinnati lathes and drills



The three 800-ton Elmes® Hydraulic Extrusion Presses shown above are at work at Mullins Manufacturing Corporation, producing remarkable Koldflo one-piece extrusions from cold steel. Mullins specialists on the Koldflo process state that these Elmes Presses give "thoroughly dependable" performance and are outstanding for "trouble-free operation".

Many important features, typical of Elmes custom-engineering for special metal-working applications, enable these presses to meet exacting demands of the cold extrusion process. Among these features are:

- Manual, hydraulic bleed-off type inching control—a real time-saver in die-setting.
- Stroke and slow-down speeds controlled from operator's position.
- Ring-key positioning, assuring constantly maintained "all directional" alignment of press crown, bed, and housings.
- Slide gibs, faced with non-metallic lining, reducing friction and assuring long life of ways.
- Exceptionally long adjustable gibs for accurate alignment of slide.
- Pre-fill valve equipped with built-in decompression valve, for shock-free operation.

Like Mullins, you too will find it pays to bring your "pressing problems" to Elmes. For complete details on any or all types of Elmes Metalworking Presses—drawing and forming, extrusion, forcing, bending, straightening, etc.—see your authorized Elmes Distributor, or write to us direct.

**Trade Mark, Mullins Mfg. Corp., Salem, Ohio*

ELMES

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HYDRAULIC PRESSES & EQUIPMENT

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS

Spot News of Metalworking . . .

- **Cadillac's Cleveland Tank Plant is designated a "vehicles engineering agency"** by the government. This means the engineering job of keeping the Army's light tank family abreast of the times rests with the plant's engineering staff, which will research tools and gaging and improve tank types.

- **First all-Italian built-and-designed jet engine** is being built by Fiat. It weighs 180 lb, can reach 54,000 rpm, has 550-lb thrust.

Automation has started a new trend in labor negotiations. Instead of concentrating on pay increases in automated plants, the unions are now more concerned with seniority rights and new rates of pay for semi-skilled and skilled workers who are on different or upgraded jobs because of switchovers to automatic processes.

- **They're using stainless steel for money down in Costa Rica,** claim the new 5- and 10-cent pieces not only look pretty, they outlast all other coins.

- **Now's the time to get your apprentices deferred from military service.** Bureau of Apprenticeship says less than 2½% of the 250,000 apprentices in U S industry have applied for deferments, or had their firms do it for them.

- **You can rent welding equipment now.** A Detroit firm will lease either standard or special equipment in what it says is the first such plan in the welding field.

- **Foremen aren't getting the authority they should have** in most firms, according to an American Management Association poll of 66 companies. Example: four-fifths of the surveyed companies expect foremen to discipline employes, but fewer than half allow them to demote or discharge for cause.

Bendix Aviation Corp's new "cam machine" uses electronics to turn a blueprint into a complex finished product, performing in two to four hours an operation that formerly required 400 manhours. Coded data from the blueprint is punched onto paper tape, read by a computer as to required cam shape, and instructions are relayed through servo-mechanisms to the machine tool—all automatically.

- **Automation's effect on skilled labor** will be the No 1 discussion topic at the AFL Machinists' National Tool & Die Conference in Columbus, O, October 29-30.

- **Photofluorography has moved from the medical field to industrial inspection.** This miniature-film technique has been adapted to inspection of castings and heavy weldments, cuts x-ray film and processing costs.

- **Plants in the Naugatuck Valley, Conn,** hit by the Aug 19 flash floods, have been hit again by floods from heavy rains Oct 14-17. 104-year-old Waterbury Farrell has water to machine ways, a newly laid wood-block floor buckled, is moving in the Spring to high ground at Cheshire, Conn. The new 1-story, 650x180-ft plant will house the heavy-machinery div, employ 200 people. Plume & Atwood, Thomaston, worst hit Aug 19, has water to 11 in. under the floor, but is in partial production, plans full production Nov 15—an amazing recovery. Farrell-Birmingham at Derby, and Greist Mfg have been forced to suspend because this flood hit tidal basins near Long Island Sound as well as former areas.

Complete BROACH TOOLING for Customer's Machines

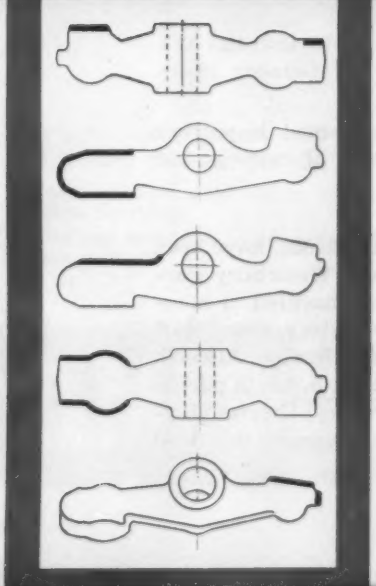
CONTINENTAL CAN RETOOL YOUR PRESENT BROACHING EQUIPMENT FOR HIGH PRODUCTION AND INTERCHANGEABILITY, AT MINIMUM COST

These forged steel rocker arms are economically processed with Continental designed and built broaches, holders and fixtures. The work is done in five operations on two vertical surface broaching machines, one having a single ram and the other a dual ram.

More and more manufacturers are turning to broaching for machining production parts. It's the fastest method of removing stock to precision limits. For a quotation on tooling for your broaching machines call in your local Ex-Cell-O Representative or contact the Continental Division of Ex-Cell-O in Detroit.

Here is the fixture and broach tooling for the first operation.

THE HEAVY LINES INDICATE THE METAL REMOVED IN EACH OF THE 5 OPERATIONS



OPERATION 1: Finish broach thrust face and broach locating surface at opposite end. Operation is done on single-ram vertical surface broach machine. Work is located in fixture on floating pin, which allows part to rest firmly on lower anvils when clamped. Spring loaded jacks are wedge locked automatically. Broaches for both cuts are carried in one holder. The only change necessary to accommodate opposite hand parts is to exchange adapters on the fixture.

Continental CTW TOOL WORKS

Division of EX-CELL-O Corporation, Detroit 32, Mich.

55-30

Washington . . .

New mobilization policy . . .

The National Security Council has made a major change in mobilization policy, has shelved plans for a massive 18-month mobilization buildup in case of war. New plans call for a quicker emergency mobilization over a six-month period. Reason for the policy switch: an NSC determination that latest developments in nuclear weapons make it unlikely that another World War would last more than a half-year. This is pretty much in line with a thesis the Air Force has been arguing for some time.

The policy change apparently was made many months ago. It unexpectedly was revealed this month when the Reserve Officers Assn disclosed wide-scale deactivations of reserve Army units and denounced this action as a threat to the Military Reserve Program. As a result of NSC's new policy, the Army ordered the deactivation of 358 reserve companies and the conversion of 15 under-manned reserve divisions into non-combat units.

Presumably, impact of the new mobilization policy will be felt far beyond manpower decisions. Other defense programs—procurement, production, stockpiling—are almost sure to be affected. But up to now such effects have not become apparent.

No defense spending cuts . . .

The Pentagon has put a crimp into the administration's drive for a balanced budget by next June 30. Instead of cutting military expenditures—the key to the administration effort—Defense Secretary Wilson has announced that Defense Dept spending in fiscal 1956 will now be $500 million over original estimates, $34.5 billion. That's probably rock-bottom, Pentagon budget officials believe.

Wilson's announcement was aimed to deflate Democratic charges that the Republicans are putting back arms deliveries to balance the budget. Last August, Treasury Secretary Humphrey reported a budget deficit of only $1.7 billion, said the budget "could and should" be balanced by a 3% reduction in federal expenditures. For the Defense Dept, this meant a spending total of $33 billion.

At that time, Pentagon officials warned that military spending could not be significantly affected by next June 30 because of the long lead-times for the more costly military equipment. But they did concede that they were studying possible stretchouts in arms production, "screening out of marginal projects," and the like. Wilson's latest announcement should put an end to talk about fiscal 1956 cutbacks. As for fiscal 1957, the outlook is pretty much up in the air, even though most Defense Dept officials assert that military expenditures will stay at the $34-billion level for at least two more years—"give or take $2 billion."

Background on latest military estimates . . .

The Pentagon's increased expenditure estimate doesn't mean that new programs are under way. When the $34 billion figure was first set, it was explained that total estimates actually came to $1.7 billion more. But based on past experiences with production slippages and other adjustments, budget officials figured that the $1.7 billion would never be spent.

So far, however, only about $500 million of this has shown up. And to offset such savings, there have been unexpected increases in cash outlays of about $800 million.

The reasons . . .

These stem from a number of factors:

The step-up in B-52 bomber production and resulting advances in machine tool deliveries for the project; a last-minute increase in the size of the military forces, authorized by the President after the budget was sent to Congress; and the general upward trend in procurement costs.

Wage settlements in the automotive and steel industries and the price hikes in copper and aluminum, for instance, are all reflected in what the Defense Dept has to pay for military goods. The bulk of military procurement contracts contain price redetermination clauses allowing suppliers to be compensated for such unexpected cost increases as the ones mentioned.

Green light for tankers . . .

The way has been cleared for the Military Sea Transportation Service's Charter-Build Tanker Program. General Accounting Office, which has been probing the method of handling bids on the program, has backed up MSTS on a controversial award made to United Oceanic Corp of NY

Authorized last year, the program provides for private firms to build 15 tankers at a total cost of about $130 million, then lease them to MSTS under 10-year charters. But from the start, the program has been bogged down. Latest stir came last June 30 when MSTS opened bids from four companies offering to build tankers. At that time, United Oceanic was awarded a contract to construct eight ships. MSTS tossed out the other bids. The rejected bidders immediately cried foul and stirred up enough interest to have Senator Magnuson (D, Wash) ask GAO to look into the matter.

With MSTS now upheld in its handling of bids, it remains for the service to either ask for new bids on the seven remaining tankers—as it said it would on June 30—or possibly pick up some of the rejected bids.

MICROHONING* . . . FACTS YOU SHOULD KNOW

Compare These Microhoning Advantages

- Rapid and efficient stock removal.
- Dimensional accuracy obtained in every part.
- Macrogeometric accuracy—the Microhoning action is not affected by vibration; long abrasive stones generate a true surface.
- Microgeometric accuracy—any desired surface finish and cross-hatch angle duplicated in every part.
- No concentration of heat—the structural surface of the part is undamaged.
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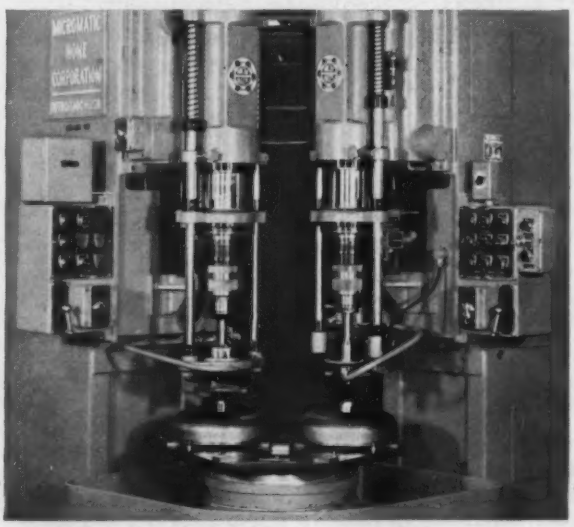
- No practical limitation on part length and diameter.
- No chip removal problem—the minute Microhoning chips are flushed away in the coolant and automatically removed.
- Automatic size control.
- Readily adapted to automation.
- Eliminates tool dressing time and cost.
- Location of bores is undisturbed.
- Float principle and low speeds assure minimum maintenance.
- Backed by over 26 years of engineering and service experience.

PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC — TRADE MARK

Microhoning is a low-velocity abrading process that employs thousands of small cutting tips. Because simultaneous and continuous cutting action of tips is spread over a wide area, stock is rapidly removed with a minimum of heating. This abrading technique generates functional surfaces ***by obtaining in one operation the required tolerances, specifications, or condition*** of the surface characteristics.

Included in these characteristics are: dimensional size (the distance between points or faces of a part, e.g., the diameter of a bore); macrogeometry (waves whose crests are more than 1/32" apart); microgeometry (roughness or scratches whose crests are less than 1/32" apart); and surface structure.



Microhoning . . . Example Application

Microhoning both I.D. and O.D. of the hub of a transmission torus cover to generate geometric accuracy and a surface finish of 10 microinches.

O.D.—*2.375", approx. 1" long, blind end*
I.D. —*2.125" x .280" long*
58-60 Rockwell "C"
Stock removal: *.001" to .002"*
Surface finish: *10 microinches*
Production: *180 per hour, gross.*

***MICROHONING = Stock Removal + Geometry + Size Control + Surface Finish**

Movies describing various machining processes and the generation of functional surfaces are available for group meetings. For literature or further information on films, write to:

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Detroit . . .

AMC ups its '57 Tooling . . .

American Motors Corp, announcing its new lines of Nash and Hudson cars in a press review at Burlington, Wis, revealed that body design changes in its 1957 Nash and Hudson lines will increase tooling and machining spending 35-50% over present outlay.

President Eisenhower's illness . . .

may have caused a stock market scare but it's not causing industry to pull in its horns on expanding programs. A quick check of major Detroit industrialists revealed that despite the political winds that blow in the next four years there is no intention of slowing down the gigantic programs that are now under way.

Ford's awhile-back announcement . . .

that it will spend some $500 million for expansion indicated, in some papers and magazines, that the expenditure was an "extra" sum, not previously allocated. Such is not the case. Ford's over-all spending policy for expansion looks like this: Postwar commitments were pegged at 2.4 billions of dollars. Up to September 1st, 1955, they still have 865 millions left of that original sum — which will be spent in expansion of plants, associated machinery and tooling by 1958.

There's widespread talk in Detroit . . .

about air springs for some trucks in 1956. One spokesman pointed out that several problems still remain to be solved. Air springs, now in use in GMC coaches receive increments of weight in units of passengers — 170 pounds each. Trucks, especially those in the dump line, will receive scoop loads of dirt, clay, rocks, and other weighty materials. The industry is still not quite sure that the air springs will stand the gaff.

Air springs are coming in passenger automobiles, though. Monroe Auto Equipment of Monroe, Michigan, veteran suppliers of shock absorbers to the trade (15-20,000 units per day), say they have a new "air spring" ready for the automobile manufacturer. Monroe further says that a "number of major auto companies are interested." The new system of springing for a softer ride consists of an air compressor (150 psi) mounted in the engine compartment; an air reservoir tank under the body shell and attached to the frame, four telescoping air cylinders, one for each wheel. Each air cylinder has a standard shock absorber mounted within it and an accompanying expansion tank mounted alongside the air cylinder.

It is admitedly not an after-market item—too much installation change is necessary to install the units on existing cars. Installation in new cars will call for considerable modification of body shell in the trunk area to accommodate the air cylinders and expansion tanks. Monroe points out that if industry uses their new spring system, which reportedly gives a soft, even, always level ride — the air compressor can be used to power windshields, wipers, window lifts and power steering. Although Monroe makes power steering units they have done little or no research on air power steering units.

Plymouth settled a persistent rumor . . .

at least for the time being by declaring flatly that it will not produce a V-6 engine.

Plymouth has experimented widely with the V-6 "and other types," but the decision now is that the buying public will not accept a V-6 with any more enthusiasm than they do the L-6. (Ford sells about 10% of its total output in 6 cylinder cars.) For the moment all talk about V-6's has ceased.

Regarding gas turbines . . .

auto industry engineers generally agree that it is a certainty as an automotive propulsion unit within the next 10 years. Plymouth's work with the gas turbine has apparently been highly satisfactory — Plymouth engineers shake their heads and smile a smug smile when questioned.

A A Kucher, director of Ford's engineering staff scientific laboratory, commented on the gas turbine this last week: "There is a high degree of enthusiasm, and adoption of the gas turbine as an automotive propulsion engine is a certainty." The problems, he went on to say, are many, but they will be solved without any doubt. At present a workable gas turbine costs about $15,000—and Ford people are working to get it down to $200.

One blade for a turbine, according to Kucher, costs $54; he wants to produce the entire wheel for about $25.

Techniques in handling aluminum irons are being developed to use the material for all ductile work in the turbine engines. Ford has already explored a number of turbine wheels that contain no nickel or chrome. 1965 is still the target for mass adoption of the gas turbine.

One auto engineer said, "The only thing that bothers me, and I am not an economist, is that the gas turbine will apparently sound a death knell to the transmission manufacturing plants."

Union officials and economists do not agree with the pessimistic stand that a "death knell" to transmission manufacturing plants would be harmful; 1965 is looked forward to as the beginning of the "greatest labor shortage period in the history of this country."

STEP UP Metal-Sawing Production in ALL of 7 ways:

• *The New No. 2-8 Automatic Motch & Merryweather Circular Sawing Machine.*

1. LESS TIME
2. LOWER TOOL COST
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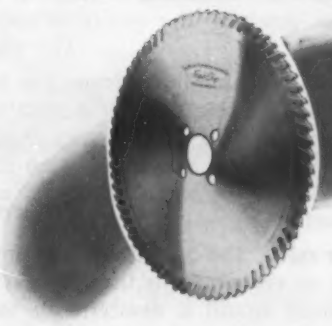

Material— 5" dia. SAE 1020

Cutting time— 54 seconds

Tool cost per piece— $ .019

IMPORTANT: Re-sharpening costs and all other tool costs are included.

ALWAYS—*it's your cost per cut that counts.* To determine that cost, all seven yardsticks listed above must be applied. You must increase usable production, get uniform accuracy, and reduce sawing costs. The Motch & Merryweather Triple-Chip Method out-performs and out-saves all others in the sawing of metal. Let us convince you.

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Machine Tools . . .

$72 million to be placed by Air Force . . .

Most of the first $100 million of reserve machine tools for the armed services, originally provided for in the government's budget for fiscal 1956 ended last June 30, have not yet been bought.

The Air Force program, which consumes $84 million of the total, has been subjected to various delays.

Even when the parceling out of orders seemed assured, last-minute postponements occurred.

Now word comes from Washington that the $72 million still uncommitted will be placed before the end of the year. This will mean that the industry's order volume from civilian sources will be swollen by that handsome figure during the current quarter.

Skin milling machines probably will be the largest single chunk of business to be awarded. As reported previously in this column, the skin millers are scheduled to be divided among four builders: Giddings & Lewis, Cincinnati Milling, Kearney & Trecker and Consolidated Machine Tool.

Second $100 million to be spent faster . . .

The second $100 million for reserve machine tools, which is part of the fiscal 1956 budget of the Defense Department, probably will not take as long to be translated into orders as the first $100 million.

One reason is that whatever portion is allocated to the Air Force will be spent on long-lead-time tools that would be a continuation of the program begun with the $84 million now being spent.

Office of Supply and Logistics at Pentagon now has at hand reports from the three services on what reserve machines and what projects they expect to use the $100 million for.

The requirements division of Supply and Logistics in turn is busy deciding what specific projects should have the green light.

Elephant tool program active again . . .

The elephant tool program has been taken down off the shelf and once more is being readied for action.

After having been whooped up into a mammoth affair which took into account the full needs of all the nation's metalworking plants for "elephants" in an emergency, it now is back where it started.

Today it is modestly intended to provide the elephant machines required only by machine tool builders who in turn will make elephant machines in case of mobilization.

On this scale, it has the blessing of the Office of Defense Mobilization, which flatly balked at approving the much larger plan. Since ODM holds the purse strings, its views prevailed.

Turbine gear program shaping up . . .

Machine tool orders stemming from the reserve turbine and turbine gear program sponsored by ODM are not expected to be in the hands of builders until the early part of 1956.

The contractors who will do the actual buying on behalf of the government (and who will take delivery of the machines as standby equipment) are now in the process of appraising their needs.

Some of these contractors already know exactly what they wish. But others don't. Anyway, enough preliminary work remains to be done that the chance of orders being placed the remainder of this year is remote.

Pratt & Whitney Co. formed . . .

Pratt & Whitney, an illustrious name in the machine tool, cutting tool and precision instruments fields, has emerged into the limelight through formation of a new corporation to be known as Pratt & Whitney Co Inc, a subsidiary of Penn-Texas Corp. It will take over the assets and business of Niles-Bement-Pond Co, which recently was merged into Penn Texas.

Alexander H d'Arcambal is president and general manager of Pratt & Whitney, with Richard W Banfield as vice president and manager of the small tool and gage divisions, and A L Knapp as vice president and manager of the Machine Tool Division. L D Silberstein is chairman of the board.

Potter & Johnston Co, Pawtucket, R I, will become a direct subsidiary of Pratt & Whitney, with Edward P Gillane continuing as president and general manager and Mr d'Arcambal as board chairman.

Chandler-Evans will be operated as a division of Pratt & Whitney, with Sidney A Stewart in charge.

New pool-order plan being set up . . .

The pool-order proposal just drafted by government agencies for use in a national emergency was the subject of discussion at a meeting in Washington on October 18 of the Machine Tool Industry Advisory Committee of the Business and Defense Services Administration, Department of Commerce.

Some 25 machine tool builders representing all segments of the industry participated.

What the industry would like to have is a program set up to become effective the minute mobilization becomes necessary. There were long delays in getting such a program going in the Korean emergency.

BDSA report to the Joint Congressional Committee on Defense Production declares that the Korean pool-order program "failed to achieve the initial and short-term objectives of immediately accelerating and expanding industrial capacity to produce."

BF

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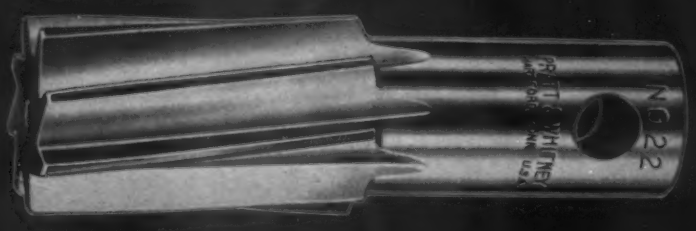

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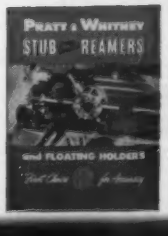

(Advertisement)

CARBIDE TOOLING GREATLY INCREASES PRODUCTION AND LOWERS COSTS

But P&W Survey Proves Scientific Application Engineering Essential

Long realizing the great potential value of carbide tooling to American industry, Pratt & Whitney has for the past ten years conducted a program of exhaustive research in the design, manufacture and performance of carbide cutting tools. This program has proved conclusively that carbide is certainly the tool of today *and* tomorrow. Production records show that a carbide tool may last up to 200 times longer than conventional tools of the same general design. Tool costs per workpiece are greatly reduced. Machine down time for changing and sharpening tools is sharply cut. For example, when recutting "workedout" forging dies many of the steps previously required can be eliminated when the die is resunk with carbide die sinking cutters. Work which formerly required *days* can now be done in a few *hours*. Also, newly developed alloys, stainless steels and plastics with a high abrasive content can be cut with substantial savings with carbides.

In addition, carbides have demonstrated their marked superiority over abrasive points for finishing small holes and other similar operations. After finishing a predetermined number of holes, the front end of the carbide tool is honed with a diamond lap to restore the keen cutting edges; machine down time that would be required for changing or dressing mounted points is eliminated, and production increases of *1000%* have been realized!

While the Pratt & Whitney program has certainly proved the great production potential of carbide tooling, it has also proved that scientific application engineering, based on experience and extensive fact-finding research, is essential to the full realization of this potential. Too often, manufacturers have tried to apply carbide tools with no thought of determining correct speed (especially critical when carbide is used), feed, load and horsepower etc. For optimum performance, the material, depth and type of cut, rate of cutting desired, finish required and other factors must be considered and carefully evaluated before a carbide tool can successfully replace a conventional tool. There can be no chatter or vibration at the point of contact. The correct *grade* of carbide is another important consideration, and careful study is required to determine the best grade for each individual application.

Pratt & Whitney has enlarged its carbide tool line; burs, die sinking cutters, end mills, reamers, boring bars and other standard and special tools are now included. The results of its ten-year field survey, in conjunction with its Cutting Tool Research Laboratory places Pratt & Whitney in an enviable position to make a scientific analysis of customers' job requirements, and to provide the right carbide cutting tool for the job *plus* operating recommendations that will insure maximum economy and productive efficiency.

PRATT & WHITNEY CUTTING TOOL RESEARCH LAB PROVIDES VITAL BASIC DATA

While the past decade has seen many important developments in cutting tool progress, there still remains a significant lack of basic scientific research in this vital field. What happens when cut-

ting edge meets workpiece under various conditions is largely a matter of conjecture or supposition . . . not of exact knowledge.

To remedy this deficiency . . . to provide a foundation of basic data essential to the development of cutting tools that can meet today's demands for faster, more accurate metal removal, longer wear life and lower tooling costs . . . Pratt & Whitney has recently set up a Cutting Tool Research Laboratory and instituted a program of intensive scientific research.

Completely equipped Pratt & Whitney Cutting Tool Research Laboratory

This laboratory is expertly staffed and completely equipped; included are the latest machine tools . . . milling machines, automatic screw machines, lathes, drill presses, tapping machines, automatic nut tapping machines, and tool sharpening and surface finishing machines . . . for running all types of cutting tools under closely-controlled test conditions and evaluating the many variable factors that affect tool performance.

Indicating and recording equipment is up-to-date and complete. Tool dynamometers (used in conjunction with a Sanborn Recorder to provide a permanent record) measure torque, thrust and 3-dimensional cutting forces; sensitive watt meters indicate and record the smallest fluctuations in power requirement during cutting. High speed photographic equipment capable of taking 3000 single frames per second allows slow motion studies of chip formation, chip travel and the flexing of tools under load. Magnification up to 1500 times makes the most minute details of cutting performance clearly visible. A General Electric computer will be used to speed the analysis of test data and insure accuracy. Electrolytic machining equipment for forming carbides and high temperature alloys to intricate shapes and close tolerances is also provided.

Optical, mechanical and electronic devices of every type are used to provide accurate measurements of tools and work. Complete facilities for metallurgical analysis . . . determining hardness, skin hardness and depth, chemical content, microstructure etc. . . . are provided by Pratt & Whitney's metallurgical laboratories.

While the primary function of this P&W Cutting Tool Laboratory is "Basic Research" . . . obtaining fundamental information about what it takes to make better cutting tools, these facilities are also used to provide P&W customers with an added service . . . "Applied Research" to determine the best combinations of tooling, set-up and operation for specific jobs. So popular has this service become that customers' sample materials or parts submitted for testing have included pieces weighing up to half a ton, and smaller components in quantities over 1000. But whatever the type of research, basic or applied the results to Pratt & Whitney customers are the same . . . the ability to machine metals always faster, more accurately and more economically.

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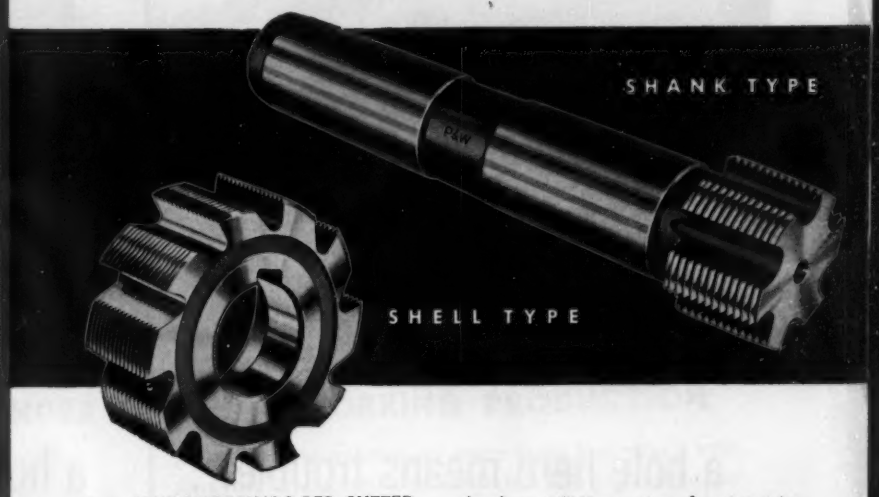
MULTIPLE THREAD MILLING CUTTERS

CUT THREAD OR GROUND THREAD



1 MORE REGRINDS PER CUTTER . . . thanks to P&W practice of maintaining the land width at the maximum practical limit.

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3 ASSURED ACCURACY . . . which eliminates rejects. Each cutter is made accurately to the required specifications and carefully inspected; in addition, a test piece is cut and the thread form inspected with a high-magnification optical comparator.

4 FAST, FREE CUTTING . . . saves production time . . . due to correct P&W design with proper rake and relief for the metal being cut.

For prompt effective service, give one of our factory-direct Sales Engineers the opportunity to analyze your thread milling and other cutting tool needs. Just write or phone the P&W Branch Office nearest you . . . see list below.

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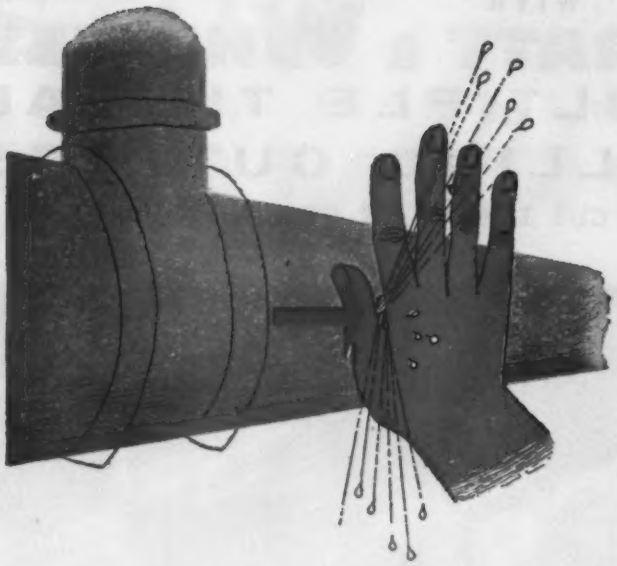
this vital field. What happens when cut-



a hole here means trouble...

a hole here saves trouble

Crucible Hollow Tool Steel Bars are a great trouble-saver for the metalworking industry. For they eliminate costly, time-consuming drilling, boring, cutting-off or rough-facing operations. And you save production time, machine capacity, and avoid scrap losses . . . for the hole is already in the steel you buy.

Crucible Hollow Tool Steel Bars are now available in any of our famous tool steel grades . . . in almost any combination of O.D. and I.D. sizes. And you get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels.

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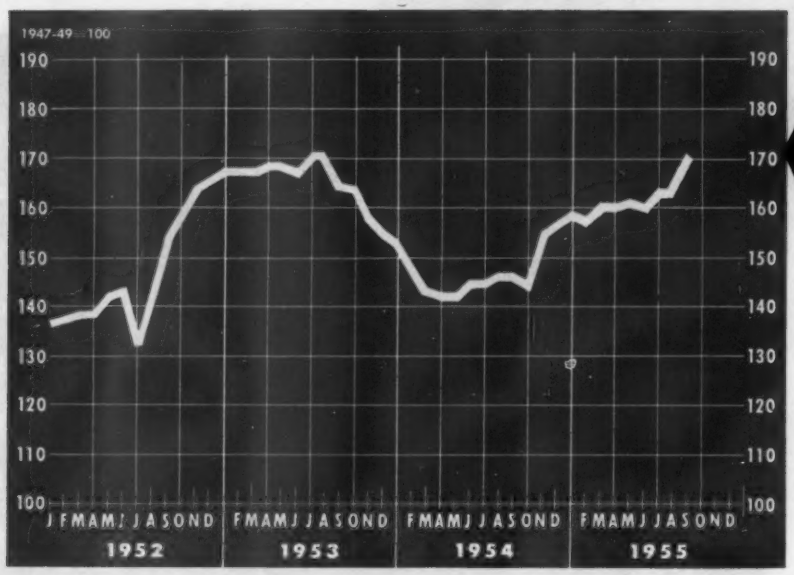
Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total idex..	171	170	167	148
Machinery	141	138	126	
Electrical Machinery	202	197	181	
Autos	139	155	97	
Other Transportation	140	138	126	
Other Metalworking	140	138	126	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Production stays at peak . . .

Metalworking production stays right up at a level never before reached in peacetime.

More than that, there is not the slightest inkling of an interruption in the amazing current rate of activities the next few months.

Take any segment of Metalworking that you please and you will get the same optimistic story.

Industrial machinery builders are going great guns. Electrical machinery people are well above a year ago and are booked far ahead.

Auto parts people have big orders . . .

The automobile record is little short of phenomenal. Auto parts makers see just as bright prospects ahead now as at any time this year. The anticipated hard bump in production during model-changeover time did not happen. Parts plants are back at near-capacity operations. They will be there through the first half of 1956.

The steel people again, as they did two weeks ago, furnish a good clue to the situation in Metalworking.

Some mills have literally been forced to open their books for first-quarter orders by the pressure on them from users. They would have liked to get their present-quarter orders in balance first.

All steel makers figure that they will go into 1956 with the first three months booked solid on all items. Merchant wire products are reported to be the only soft item.

Most steel customers are said to be trying without success to add to their steel stocks.

Gray iron casters, another Metalworking bellwether, continue to run at full capacity. They will end 1955 with the second best year in history.

Production is up 25% or more from last year's rate. And the fourth quarter will tax the industry's facilities.

Sources of castings business, in the order of importance: automobile makers, building construction industry, utilities, machine tool builders, general machinery manufacturers.

Farm equipment companies are one of the few places where a note of caution is being sounded. Falling farm prices are responsible. It is hard to tell at this point how much farm machinery sales will be affected by the lowered purchasing power of farmers.

Tools and dies are improving . . .

Tool and die shipments for this year so far have been running 90% of last year's figure, according to the National Tool & Die Manufacturers' Association. August did a little better than the year's average, 95% over August 1954.

Tool and die employment rose 2% in August and is at the high-water mark for this year. New orders for tools and dies were up 10% in August over July and were running 8% ahead of August 1954. Pickup in new orders was particularly noticeable in New England and the Middle Atlantic states, with the exception of Philadelphia where orders are still pretty slow. Tool and die new orders volume in the Midwest is good, and on the West Coast it's excellent.

Freight car building is stymied . . .

The railroad freight car builders can't get up full steam because of inability to get enough steel—even though they are getting more and more orders on their books.

This isn't true of passenger car output, where orders are still hard to come by.

Gaging Business . . .

Price Index

	SEPT. Esti-mated	AUG. Pre-liminary	JULY Re-vised	AUG. Year Ago
Total Index	**137.5**	**139.9**	**135.8**	**132.6**
Metalworking Machinery		**156.5**	**155.4**	**141.7**
Other Machinery exc. Electrical		**141.9**	**140.3**	**137.4**
Electrical Machinery		**132.8**	**131.9**	**130.9**
Fabricated Metal Products		**132.4**	**131.5**	**129.1**

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

Business boom to continue . . .

The business boom shows no signs of losing its momentum in the near future.

It gives evidence of continuing at full pace the final two months of this year and the first half of next year. What happens beyond that time is a little hard to predict at this time.

This is not to say that President Eisenhower's illness is of slight consequence to the business community and its outlook.

Its profound political and economic effects, rather, are of the sort to have a telling impact on business over the longer run than in the weeks right ahead.

Here are the reasons why . . .

Here are some of the reasons why the business boom is likely to go merrily on its way:

Industry's plans for investing in new plant and equipment, now at a record level, are not expected to be cut back substantially.

Investment in public facilities—highways, schools—will continue to mount.

Consumer purchases, bolstered by higher wage rates, will hold up and even may increase.

The automobile industry will not fall much short, if at all, of its amazing record of recent months. Production schedules ahead are tremendous.

Industrial output at new peak . . .

Industrial production hit an all-time high during September. The Federal Reserve Index was at 141, or 14% better than a year ago.

Output of goods in general is at or very close to full capacity in many lines—steel, aluminum, copper, automobiles, electrical apparatus, chemicals, paper, rubber, petroleum.

Running extra shifts is the only way in which the FRB index of manufacturing production could go much higher right now. If the index reached 160, it would mean that all industries were up to the top limit.

The cost-of-living index has not yet been affected by the price increases taking place all along the line in commodities.

WEEKLY BUSINESS INDICATORS

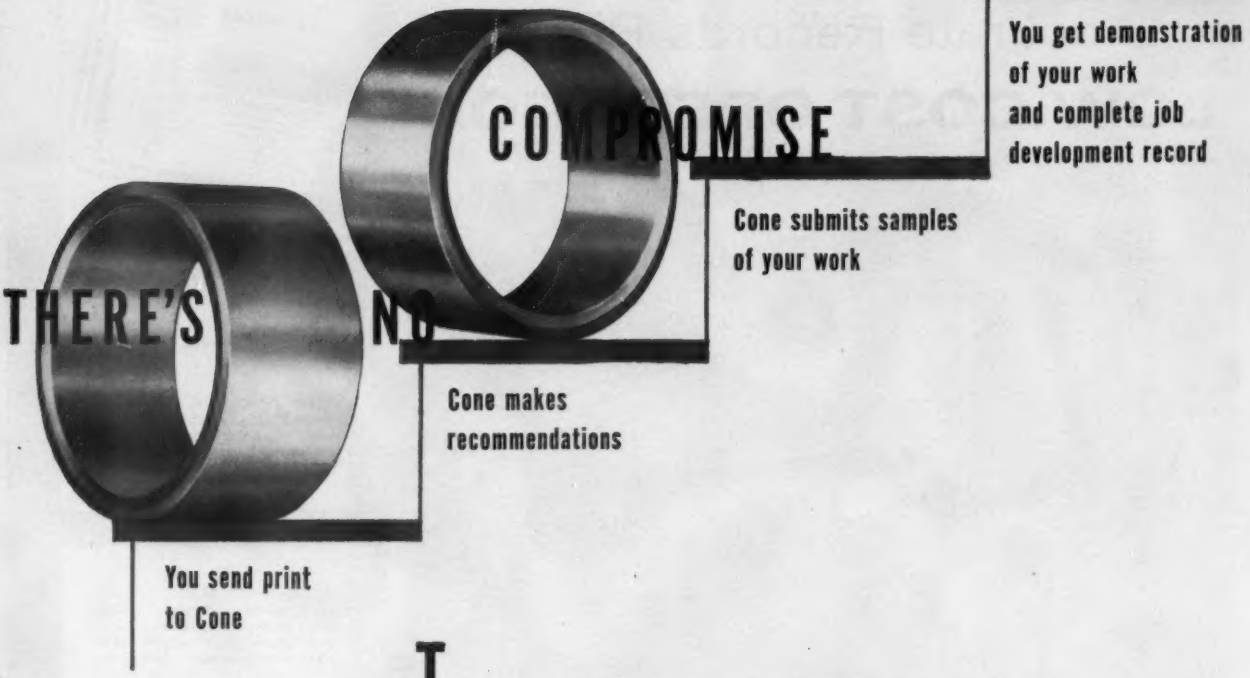
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	140.2	141.8	121.3
Steel ingot operation (thousands of tons)	2,350	2,334	1,735
Electric power output (million kilowatt hours)	10,639	10,627	9,117
Production of automobiles and trucks	102,298	144,534	81,610
Engineering construction awards (*Eng. News-Record*—millions)	$345.8	$464.6	$259.4

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	141	140	123
Index of durable manufactures production (1947-1949 = 100)*	161	158	135
Durable goods manufacturers' sales, millions*	$13,852	$13,503	$10,701
Machinery manufacturers' sales, millions*	$ 3,520	$ 3,475	$ 2,884
Durable goods manufacturers' new orders, millions	$15,219	$13,571	$ 9,500
Machinery manufacturers' new orders, millions	$ 3,902	$ 3,656	$ 2,441

*Seasonally adjusted

No. 6 in a series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You send print to Cone
Cone makes recommendations
Cone submits samples of your work
You get demonstration of your work and complete job development record

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	⅝"
Machine	1⅝" Conomatic	Hole Dia.	1¼"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1⅝"		

Conomatic

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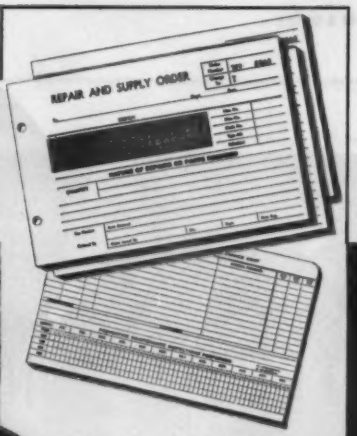
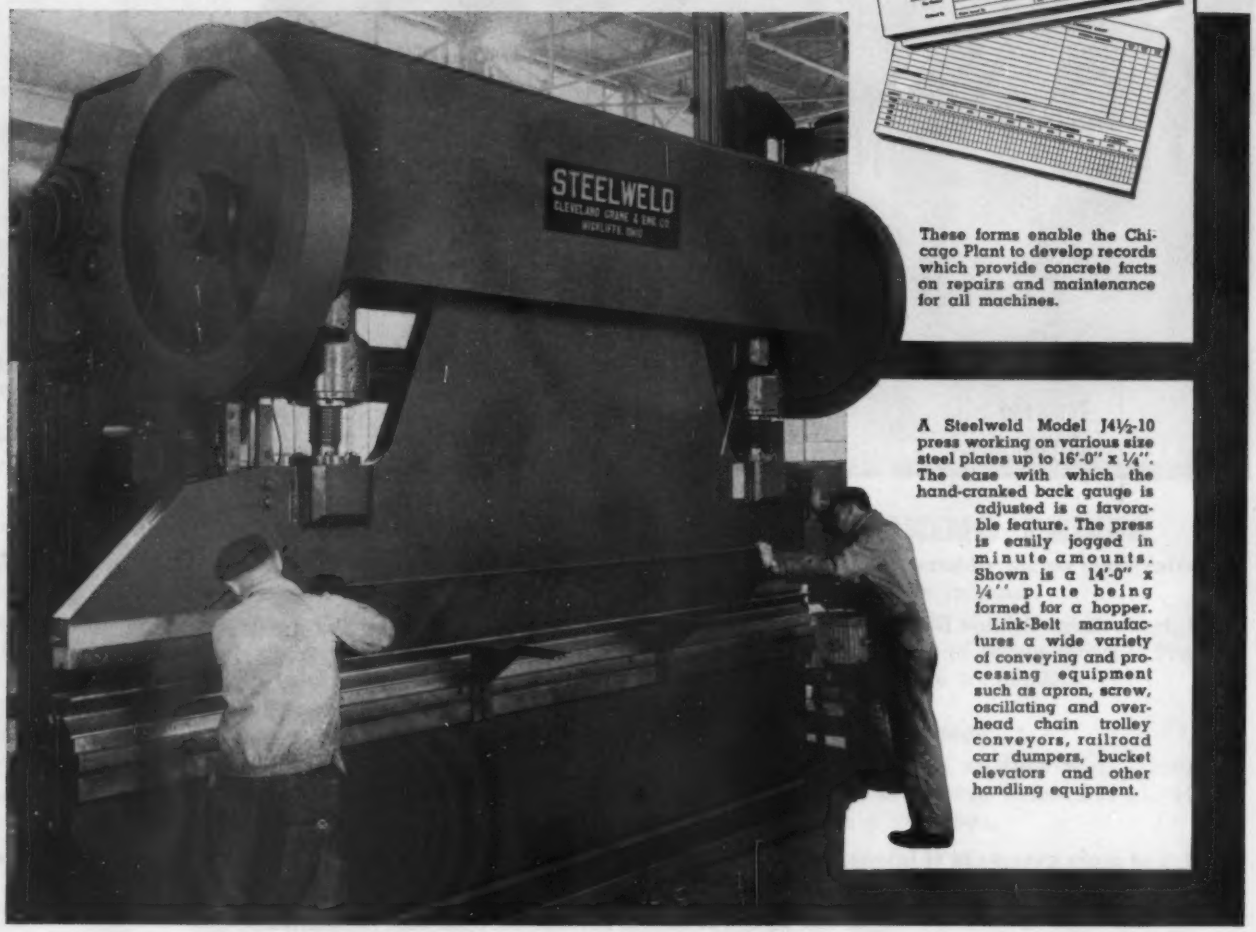
CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Accurate Records Prove
LOW COST OPERATION



These forms enable the Chicago Plant to develop records which provide concrete facts on repairs and maintenance for all machines.



A Steelweld Model J4½-10 press working on various size steel plates up to 16'-0" x ¼". The ease with which the hand-cranked back gauge is adjusted is a favorable feature. The press is easily jogged in minute amounts. Shown is a 14'-0" x ¼" plate being formed for a hopper.

Link-Belt manufactures a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment.

SOME YEARS AGO the Pershing Road Plant of Link-Belt Company, Chicago, established a record system for keeping track of repairs and maintenance costs of all machine tools. This system provides a detailed history of maintenance required and lists every item of expense for every machine.

The record system proves that the maintenance cost for Steelweld machines, both bending presses and shears, is comparatively low.

Because of this, and the fact that Steelweld machines have many desirable operational features, a number of which are unavailable elsewhere, Link-Belt regards them highly. In fact, so much that 20 Steelweld Presses and Shears are now serving Link-Belt plants in nine cities.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

The Urge Is Irresistible

If the rise in productivity in Metalworking has astounded you, wait until you see what happens the next five years.

The record up to now is very impressive, to be sure. From 1923 to 1953, through boom times and a major depression and a world war, output per man doubled. It jumped 23% in the eight-year period from 1946 to 1953 inclusive.

From the beginning of 1954 to the middle of this year, best Washington estimates put the gain at 4% to 6% annually. That is way ahead of the highly commendable average of 3% a year that prevailed during the previous eight years.

Nothing looms on the horizon to prevent a continuation of the amazing productivity pace set by American industry in recent months. If anything, the pace will be stepped up further.

This is not an idle prediction. It is based upon clearly discernible trends.

For one thing, all production processes are being mechanized faster than they were a few years ago. The idea of automating production wherever possible has caught on.

Even the small metalworking shops are thinking in terms of how they can turn out more goods without adding to the work force and without paying for expensive overtime.

Human labor is costing management more and more each year. The added cost is not all represented in the hourly rate. It is also the vacations with pay, the paid holidays, the pensions, the insurance benefits, the unemployment insurance, and a dozen other items.

But it is more than that. The worker's comfort and health must be looked after as never before. He must have good eating facilities, recreational equipment, medical care, adequate parking space, and so on.

He must not be asked to lift work around as he used to (and properly so). If he is to produce more, the extra must not come from the expenditure of more energy on his part.

Then there is the machine side of production as well as the human side. Machines are a lot better than they were eight to ten years ago.

They are bigger and sturdier. They run faster, are more flexible, and do more work. Their cutting tools are better. Work can be loaded into them and removed and passed on to the next machine much more quickly. And the quality of the job, in many cases, is much improved.

Perhaps you, along with tens of thousands of other visitors, had the experience at the recent Machine Tool Show of watching almost incredible performances by 1955-designed machine tools. They made previous production totals look pale.

Small wonder that management has turned increasingly to machine power to do the tasks formerly done by human power. In 1948, the amount of money invested per production worker in the metalworking industries was $8000. By 1951 the figure had swelled to $11,000. Today the Machinery Institute puts it at $12,500.

Is it too much to expect that by 1960 it will have gone up to $15,000 or even higher?

Yes, the urge on the part of metalworking management to mechanize is irresistible. Everything is in its favor—a never-endingrise in labor costs, disinclination of workers to do hard jobs, a search for lower costs and higher profits.

More mechanization inevitably means greater productivity. And that brings us, once again, to the theme that the fastest upswing in productivity in history is just ahead.

With this thought in mind, you had better see exactly where you are, in case you don't know. Just remember that you cannot afford to stand still, at least not for long. The management that fails to mechanize to the greatest extent possible is going to be a pushover for a live competitor.

Burnham Finney

EDITOR

Photos courtesy Kiss & Blum, Cincinnati, Ohio

72 HOLES

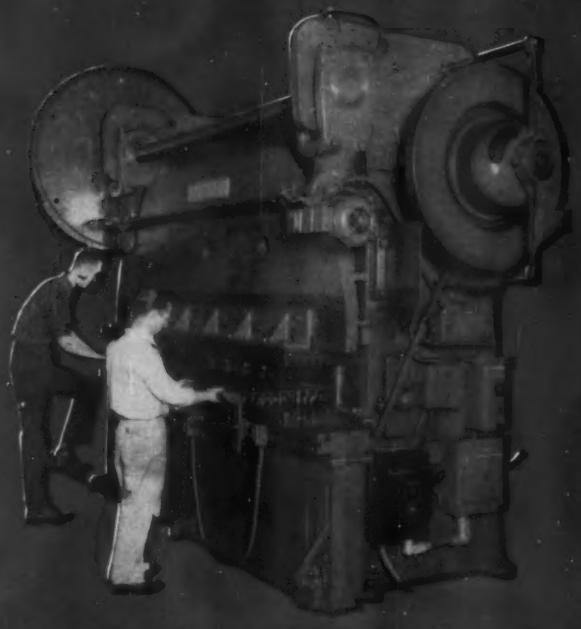
where they belong

Economical assembly depended on maintaining the accurate spacing of these 72 holes and their accurate positioning on this 10-gauge sheet.

This Cincinnati Press Brake is giving a high production at low cost by its speed and accuracy of performance, which insures rapid low cost assembly.

As a press, they offer high production with low investment. As a Press Brake, their low set-up costs, quick change-overs and versatility bring profits.

Write for Catalog B-4 where many examples of the versatility of Cincinnati Press Brakes are illustrated.

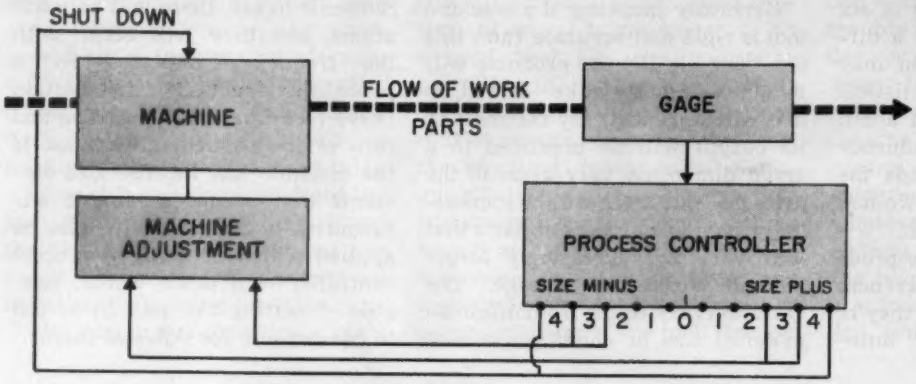


CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

American Machinist



TYPICAL BLOCK DIAGRAM of a process controller

What's All This About Probability?

E J TANGERMAN, executive editor

Self-resetting machine tools apply the principles of the theory of probability to control. Because such machines are already appearing in a variety of applications, we provide an explanation of the subject in terms simple enough to be understood by its author, who admits to a thick head on such subjects

A machinist making a new part shape roughs it by eye, then begins a series of more-and-more accurate cuts, checking each with mike or templet as he goes. Eventually, he arrives at the finished shape and size—having been his own quality-control device all the way.

If he makes additional like pieces, his roughing by eye comes increasingly close to the finished dimensions, and he marks dials and drums with chalk to give him his stop points quickly. Here he is refining the control—but he still mikes or gages during finishing cuts to maintain control.

If he is breaking in a new machine, he also mikes frequently, to see how closely a depth as set on the dial is actually achieved by the machine tool. He is, in other words, testing machine capability.

Put these two ideas together, add automatic control, and you have a self-resetting machine tool.

First indications of self-resetting were on the internal grinder as early as 1931, when Bryant used a pair of carbon rings to control wheel setting for size. Since then, we have seen development of automatic sizing—first in internal grinders, then in cylindrical. In internal grinding, it's easy—the wheel passes a dresser that holds it to desired dimension. In cylindrical, a snap-over go-not-go gage checks continuously or periodically during rough grinding, then may cut the feed and let the wheel spark out if tolerances are not too close. For tight tolerances, the sparkout portion of the cycle is also positively controlled. This again is easy because the relatively small depth of feed allows continuous gaging and makes an undersize piece unlikely.

Self-resetting for machines with a tool or cutter rather than a wheel has, however, been a more-difficult problem. First step in this direction was the twin-lathe camshaft setup of two years ago (*AM*—Mar 29 '54, p110) in which newly turned diameters were checked in a gage which shut down the lathe in case of loss of tolerance, indicating which dimension was at fault. In the past six months, actual self-resetting machine tools have, however, appeared in several production setups, including the Buick pinion line (*AM*, Aug 1 '55, p115), the Plymouth engine-block line (*AM*, Aug 15 '55, p88N), several lathes for GE-Fort Wayne and satellite plants (*AM*, Mar 14 '55, p117; Aug 15 '55, p144; Sept 26 '55, p126), and self-resetting gear hobbers (*AM*, June 6 '55, p121; Aug 29 '55, p243).

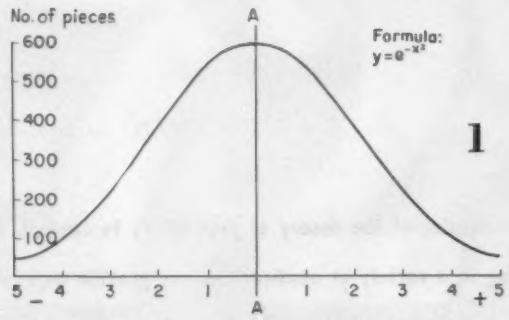
Actually, the modern self-resetting machine tool is a quality-control device, and as such operates on probability theory. You may or may not recall the latter as a

convenient way of explaining why certain poker hands or dice combinations turn up when you've bet the other way, or why one of six kids turns up with eyes of a different color. Or, again, you may have heard the experts in statistical quality control sounding off about them. Because they'll be influencing your machining methods increasingly as time goes on, we had perhaps better discuss them.

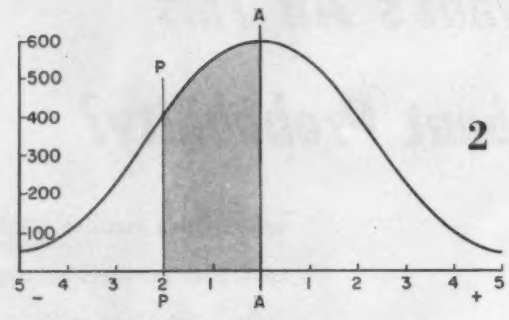
If any normal process, the products are not identical. Differences may be very small, but they're there—witness the "lemon" automobile or appliance, just like all the others except that it doesn't work as well.

Generally speaking, if a machine tool is rigid and accurate (and this is a very big IF), its products will be almost exactly alike—it will, as it is called, repeat. By far most of its output will be produced to a given dimension very close to the average. But there will be increasingly *smaller* numbers of parts that will vary by increasingly *larger* amounts from the average. The variation may result from original-material size or condition, a momentary condition, changes in machine or coolant temperature, wear in the tool, and other factors. Suffice it to say, there will be variations, and they will occur with the frequency indicated by a probability function or distribution curve (see diagrams), based on test runs of the particular machine. If the machine tool incorporates elements that permit automatic adjustment, a gaging device can be applied which is really a process controller — in other words, capable of setting the tool in or out to compensate for out-size pieces.

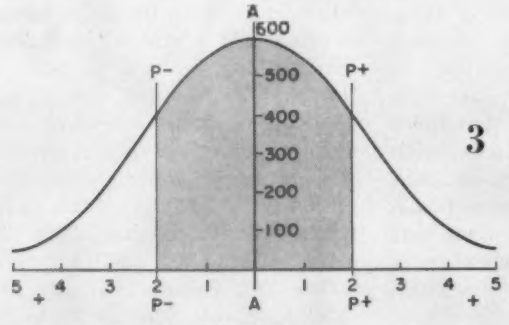
HERE IS A SIMPLE EXPLANATION OF A PROBABILITY CURVE . . .



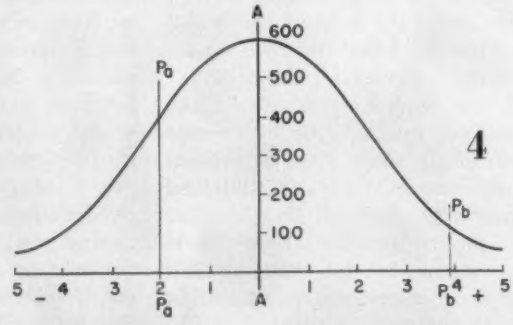
VARIATIONS FROM A NORM—be it the distance pattern of cards from the hat at which you throw them, bullets fired from a fixed gun at a fixed target, or a given dimension of pieces turned out in succession from a machine tool—form a predictable pattern called a probability or distribution curve like that above. In this curve, the base line (abscissa) is divided into ten-thousandths inch over or under the ideal. Vertical line A-A (the ordinate) represents this ideal, or distribution center. All parts made may be expected to have the given dimension fall under this curve



ANY ORDINATE, SUCH AS P-P, is an estimate of the number of parts likely to have that dimension—in other words, shows the probability of its occurrence. In this case, the line indicates that for every 6 parts of exact dimension, there will be 4 that are 0.0002 in. undersize. Also, the area PAAP (shaded—which in calculus would be the integration of all the ordinates from A-A to P-P) is proportional to the likelihood that the dimension will occur in this area. The area to left of P-P is likewise proportional to the likelihood that the dimension will be still smaller than the ideal—0.0002 in.



NOW LET'S CONSIDER TOTAL PROBABILITY. Call the entire area under the curve unity, or 1 . Obviously, any part of the area will be less than the total. Area P^-AAP^- could be measured with a planimeter and compared with the total to the left of A-A, or any other, and give the comparative likelihood of the given dimension occurring in the two zones compared. Let's assume area P^-AAP^- is 3/10, that to left of P^-P^- is 2/10. Then the likelihood of the given dimension being between 0.0002 in. undersize and 0.0002 in. oversize (area $P^-P^+P^+P^-$) is 6/10, of it being beyond that tolerance 4/10 (four in ten)



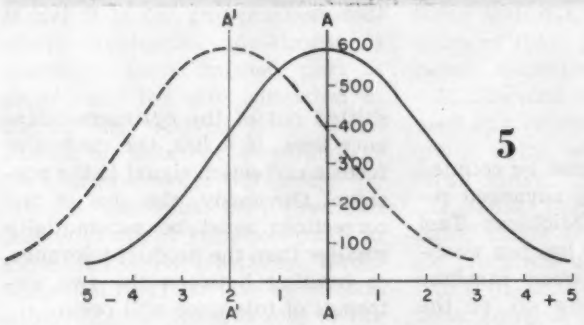
LIKELIHOOD OF A COMBINATION of events occurring simultaneously can also be figured from the curve. Let's assume the likelihood of P_a occurring is 4/6, as shown, that of P_b occurring is 1/6. Then the likelihood of both occurring together is 4/6 x 1/6 = 4/36 = 1/9, or one chance in 9. Further, the chance that one dimension will occur between the ideal and −0.0002 in. (line P_a), and that another will be between the ideal and +0.0004 in. (line P_b) will be the product of the two areas. Assume the left-hand area is 3/10, as before, the right-hand one 45/100. Then the chance of the two events occurring together is 3/10 x 45/100 = 135/1000, or about one in eight

Automatic gages up to now have been sorting or classifying devices — they measured a dimension or series of dimensions. If critical ones were within tolerance, the piece passed on; if they were undersize, the piece went to scrap; if oversize, it was returned for rework. Essentially, gages controlling self-resetting machines do the same thing — they still sort the good from the bad. But in addition, they *detect the tendency to go bad,* and attempt to correct the tendency by resetting the cutting machine.

This function of detection is really more sensitive than the inspection itself, because the correction must anticipate violation of tolerances if actual violation (and consequent scrap) is not to occur. It's a good deal like the policeman patrolling the beat — he's there to *prevent* trouble, as well as to stop it if it occurs. And, like the cop, the resetting device must distinguish between such to-be-expected variations from the norm as those caused by piece condition, machine tolerances, tooling play, etc; and a definite drift toward trouble, caused by wear of the tool, changes in machine or coolant temperature, or crumbling of the tool edge. One is just harmless fun to the veteran cop — the other is a signal of trouble. Both cop and inspection device depend on a memory to *detect the trend towards trouble.*

Resetting, as we said some months ago, returns to the shop the control of tolerance, for the engineering department may set whatever tolerances it likes, *as long as they are outside those of which the machine is capable.* The shop uses machine capability as the basis for setting tolerances on which

AND HERE IS HOW THE CURVE IS USED IN MACHINE CONTROL...



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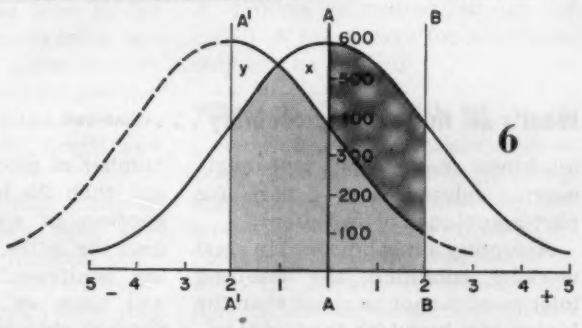
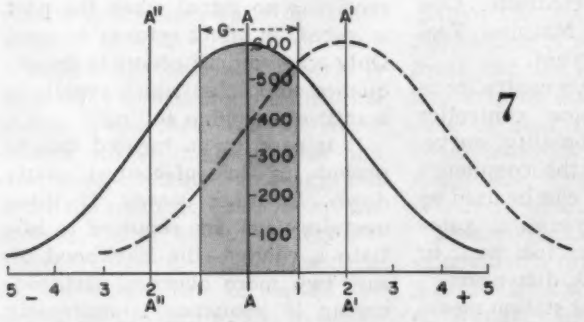
A NEW, RIGID MACHINE TOOL may be expected to produce parts with dimensions distributed under a curve like that shown in solid lines at right, assuming A-A as the ideal dimension. Let's assume that the machine, or tool, or work heats, causing expansion, so the finished dimension (line A'–A') decreases 0.0002 in. This has the effect of shifting the entire probability curve to the left, as shown by the dotted line. The likelihood of making parts within a tolerance of ±0.0002 in., originally 6/10 (see previous page), immediately declines, as in the next diagram



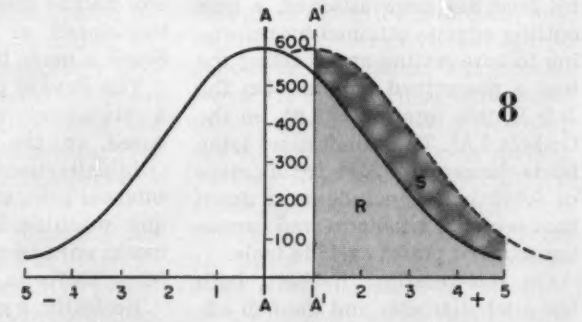
6

LIKELIHOOD OF GETTING WITHIN-TOLERANCE PARTS, after a shift of base dimension down 0.0002 in. from heat expansion, is immediately reduced as shown by loss of dark area + x. Even though area Y is gained at the same time, this is obviously unequal. Let's assume area A'AAA' is still 3/10 (gain of area Y approximately equals loss of a comparable area to its right), but area ABBA has been reduced (by loss of dark) from 3/10 to 15/100. Thus the total area within tolerance is only 3/10 x 15/100 = 45/100, as compared with an original 6/10. In other words, likelihood of getting within-tolerance parts has dropped from 60 to 45 in 100—or about 25%



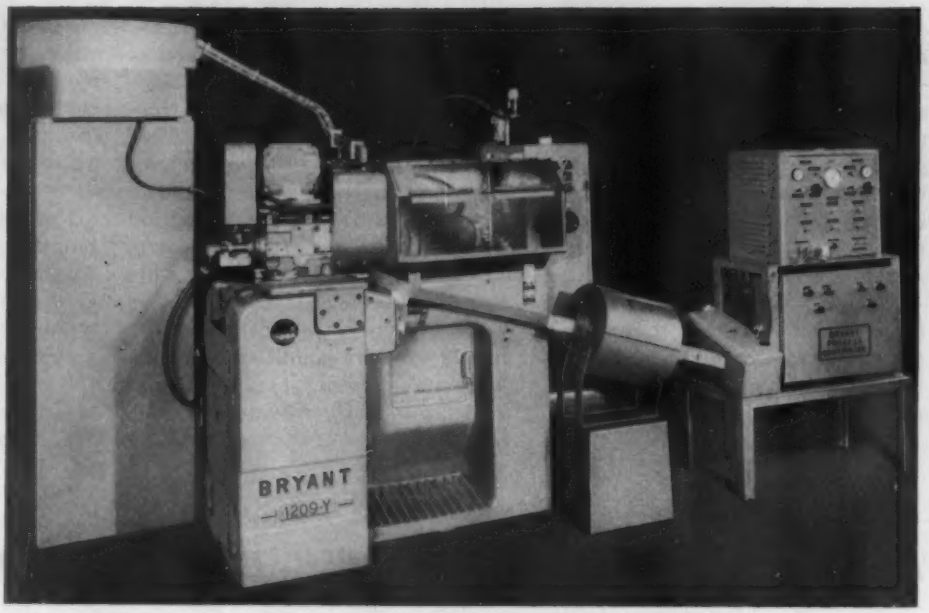
7

THE SAME THING HAPPENS when the tool wears, for example—resulting in more *oversize* parts. (In fact, the drift of line A–A to the right is steady.) If the tool wears 0.0001 in., then ideal-dimension line A–A shifts—in the case of a circular workpiece—*twice* that, or to A'–A'. Effect is as the same before—a 25% loss of within-tolerance parts. But let's put in a gage that will signal any parts that are outside 0.0001 in. of the ideal dimension, and a second one that will pass only parts within 0.0002 in. of the base dimension (A'' to A'). The latter can classify parts as within tolerance, oversize or undersize—even control sorting chutes, but the inner one can be used to correct the machine setting



8

JUST AS ONE SWALLOW DOESN'T MAKE A SUMMER (or a drink), one part with a dimension out of tolerance doesn't prove the tool needs resetting. It may be the rare "sport" that hits the outer reaches under the probability curve. But if two or three are out of tolerance *in the same direction,* the machine is drifting. So that's how the machine is set. In the diagram, let's assume area R as 2/10 (original probability of an oversize part). Likelihood of three in a row in this area is 2/10 x 2/10 x 2/10 = 6/1000. But if the centerline shifts to the high side, we must add area S to this. Call it 2/10 also. Thus likelihood doubles. And when this happens, the tool is fed in



BRYANT PROCESS CONTROLLER, used with a Moore gage to control a 1209-Y grinder at the Machine Tool Show. Note part feed at upper left, internal grinder, gage station 1 at left of process-controller panel with undersize, oversize, and OK tote boxes, process-controller panel over the latter, and gage panel at upper right. The drum is a demagnetizer

What's all this about probability . . . continued

machines reset tools; uses engineering tolerances as a basis for part acceptance or rejection.

Assuming a machine tool in good working condition, the resetting tolerances cannot be closer than the increments by which the tool is advanced or withdrawn. On the Jones & Lamson lathe, for example, the increment is 0.0004 in., because the toolbit is moved 0.0002 in. each step by circular stepped cams under a tilting toolblock. This and the Gisholt lathes both have carbide disks for tools, so when total feed has been attained, a new cutting edge is attained by returning to base setting and rotating the tool a prescribed amount. On the J & L, this rotation is 3.6°, on the Gisholt 7.5°. The Sundstrand lathe feeds the carriage forward six steps of 0.005 in., then indexes a drum that replaces a toolpost and carries ten pairs of preset carbide tools.

On self-resetting hobbers, both the pitch diameter and the hob advance must be controlled, so two dimensions must be gaged — the pitch diameter to adjust distance between hob and work axes, and some sensitive point (on the Lees-Bradner machines, it is root-fillet radius) to determine when the hob is beginning to wear and requires advance. Otherwise, some arbitrary number of pieces must be counted out, then the hob is advanced regardless of wear. Michigan Tool does the latter, also has put washing equipment between machine and gage, so cutting oil or the vagrant chip will not affect measurements.

Most gaging devices are actually separate inspection machines, thus can be applied to more than one kind of machine tool with only slight modification. This is resulting in a new kind of metalworking equipment, in effect a process-control unit or process controller. One introduced at the Machine Tool Show is made by Bryant.

The Bryant process controller is a statistical machine controller based on the probability curve. Originally used on the company's internal grinders, it can be used on any machine incorporating automatic adjustment for tool wear or other shifts in work dimension.

Basically, a gaging station measures parts coming off a machine, classifies them as acceptable or under- or over-size, then puts the size information into the proper category. Information on the number of parts in each category is fed to the process controller, which determines, on the basis of probability, whether the process has shifted out of the optimum-tolerance area. If it has, the controller feeds a correction signal to the machine. Obviously, the size of the corrections must be substantially smaller than the product tolerance, or hunting between the two extremes of tolerance will occur.

The decision to change is based on sums fed to counters in the controller. One counter adds up oversize parts, the other undersize—each must arrive at a sequential predetermined total (usually three parts in sequence) to signal a correction. If the process is stable, this is very unlikely, so the counter, receiving no signal when the part is gaged, in effect returns to zero. Only when a drift occurs is the sequence completed which results in a shift of machine setting.

It is easy to go beyond this to provide a loss-of-control shutdown. In other words, if three oversize parts are required to initiate a change, the likelihood of, say, two more oversize parts occuring in sequence is extremely small. If probability of the oversize occurrence the first time is ¼, then the resetting signal would occur at ¼ x ¼ x ¼ = 1/64, a probability of one in 64. Two more oversize parts would lower the probability to one in 1024 (¼ x ¼ x ¼ x ¼ x ¼). This is so improbable an occurrence that it is evidence that

control has been lost, so the machine would be shut down and a warning signal given.

To suit various services, various arrangements of a controller are made. Here, for example, are the types of the Bryant unit:

HOW UNITS WORK

Model A is used only on internal grinders equipped with plug sizing, and controls size by controlling the position of the dressing diamond. Limit switches contacting the finish-grind portion of the cross-feed cam report to the controller, which repositions the diamond holder after two like signals are received. Repositioning continues after the initial two like signals for each additional like signal received.

Model B is for any machine tool where automatic adjustment is provided. Each finished part is gaged, and the size compared to statistically derived fixed limits (based on inherent capability of the machine tool). Obviously, the machine tool must be a precision unit with slight variation piece to piece (excessive variation would cause hunting). If size is outside either limit, a signal is sent to the controller. After a preset number of like signals, a corrective signal is sent to the machine. Corrective signals are also counted, and if a given number of consecutive corrections fails to "center" the process, the machine is shut down and a warning signal given.

Model C is used where machine capability varies greatly or is not known. If the process is controllable, this unit will control it through automatically adjustable limits. It watches wear or other factors which might change the controlled-machine's accuracy, and shuts the machine down when the process varies beyond acceptable limits, signalling that it has done so. The actual rate of signals received by the counters is automatically compared with the expected rate, and the differences accumulated. Checking limits are automatically shifted to reduce the differences to zero as the process continues.

Size variations occur as "scatter," or as "wander" (or "trend"). Scatter is piece-to-piece size variation — resulting from variations in stock allowance, work material, hardness, etc, as well as the machine operating-tolerance range. Improved workpiece condition, use of pre-gages, improved machine design (giving higher capability), and more accurate sizing methods reduce scatter. Wander (or trend) is gradual size variation over a "run" of several pieces — resulting largely from such variables as temperature changes in the machine and diamond wear. Where practical, wander can be effectively taken care of through use of chute (or "after") gages arranged to feed back compensating signals to the machine.

Automatic sizing on an internal grinder can be done commonly by three methods, listed here in the order of their present relative accuracy, according to one authority:

1. Diamond — Diamond position used as a reference point for automatic sizing of both rough and finish grind.

2. Solid plug — Plugs can be either single or double. When single plugs are used, diamond position is the reference point for automatic sizing of the rough hole, plug for the finish. With double plugs, both plugs are reference points for size — one for rough, one for finish. The latter method is rarely used at present.

3. Air plug — Plug is reference point for automatic sizing. The air plug may be used in a "one-pressure" system in which case the diamond is the reference point for auto-sizing of rough hole, plug for finish size. Or, a two-pressure system may be used where one pressure is used for auto-sizing the rough hole, the second pressure for finish size. The latter method is relatively new.

Diamond sizing is presently not as positive a reference as plug sizing, so scatter will tend to be greater. Wander can be taken care of by feedback from a chute gage, which checks all parts and (through a process controller like Model B which analyzes trend) sends compensating signals back to the grinder, which automatically adjusts relation of diamond to work. Compensating signals are fed back as soon as size wanders appreciably from the mean hole size — *before* size has wandered far enough to fall outside customer tolerance. The chute gage can also shut the machine down if out-of-tolerance pieces are ground.

Plug sizing, in general, permits no feedback from a chute gage because the plugs are themselves positive size-reference points. An "in - the - machine" compensating device can be employed, taking signals from the machine feed mechanism. This device would "watch" the point where machine feed knocks off as size is achieved, and if this point wanders, could adjust relation of diamond to work. This is not strictly feedback, but a machine improvement; it reduces need for operator attention. (Model A process controller would be used.) A chute gage for shutdown only can be applied.

WHAT AIR PLUGS WILL DO

Air plugs will, in general, size to closer tolerances than solid plugs and do not wear. However, the air-sizing system may wander, so operators must be cautioned to check the system occasionally. In-the-machine air-sizing systems are very "sensitive" and subject to many more disturbing influences (such as distortion of hole from chucking) than chute or after gages; do not replace chute gages.

A "two-pressure" air-plug sizing system is similar to the single-pressure system, except the plug cannot presently be made small enough to enter the unground hole and still be sensitive enough to gage it at completion. The present answer is to delay plug entry until part of the rough stock is removed, and such setups are being quoted.

There is a future possibility, if air sizing becomes widespread, that feedback signals could be sent from an "after" gage to an in-the-machine air-sizing panel to "re-zero" or correct it when appreciable wander occurs. (In this case, a controller with the characteristics of the Model B would be used).

Present indications are that it may be possible to design future machines so that diamond sizing (with feedback from chute gage) will provide sufficient accuracy for most high-production needs.

PROJECT SUPPLEMENTARY

CATERPILLAR TRACTOR CO. PROJECT NO. _____

DATE 6-23-53

DESCRIPTION OF ASSET TO BE ACQUIRED:

(1) New No. 2 Type XYZ 3-Spindle H-S Drill.....$5,492.00
Freight..... 130.00
Installation..... 125.00

$5,747.00

LOCATION Misc Mill Line DATE REQUIRED 10-15-53

REASON FOR ADDITION: Replacement of old equipment.

The proposed drill will replace the following 3 machines: M1682, No. 4 H-S 4-spindle drill, purchased new in 1928; M3265, No. 1 vertical tapping machine, purchased used in 1928; and M6208, No. 2 H-S 1-spindle drill, purchased used in 1935. These three machines have a total of 12 hp. They have a total of 4,788 burden hours per year.

These machines have exceeded their normal service life and have excessive maintenance cost.

The proposed machine has 2 drill spindles and 1 tapping spindle, and is equipped with a 3-hp motor. It can machine the total burden of the 3 old machines with a 10% saving in burden hours and a 75% reduction in hp.

PROPERTY ACCOUNTS (MACHINERY, ATTACHED

EQUIPMENT, INSTALLATION AND FREIGHT) $ 5,747.00

EXPENSE (MOVING AND REARRANGING

MACHINERY, ETC.) $ - - - -

NEW PERMANENT TOOLING (JIGS, AVERAGE ANNUAL GAIN FROM REPLACEMENT $ 2,574.39

FIXTURES & DIES) $ - - - -

TOTAL EXPENDITURE $ 5,747.00

LESS: SALVAGE VALUE OF OLD EQUIPMENT 500.00 SAVINGS AS A % OF NET ADD. INVESTMENT 49 %

NET ADDITIONAL INVESTMENT $ 5,247.00

NEW MACHINE DATA

PURCHASE ORDER NO. _____ INSTALLATION DATE _____

CHARGE NO. _____ MACHINE NUMBER _____

PRESENT EQUIPMENT

MACHINE NAME	CLASS	NO.	YR. PURCH.	NEW OR USED	LOCATION
No. 4 [redacted] H-S Drill (4-Sp)	D643	M1682	1928	New	[redacted]
No. 1 [redacted] Vert. Tapper	T1V	M3265	1928	Used	[redacted]
No. 2 [redacted] H-S Drill (1-Sp)	D62	M6208	1935	Used	[redacted]

REPLACEMENT ANALYSIS WORK SHEET

PRESENT EQUIP.	(1) ANNUAL BURDEN HOURS	(2) LABOR RATE PER HR.	(3) MFG. BURDEN PER HR.	(4) P.T. COST PER HR.	(5) ANNUAL P.T. MAINT. HRS.	(6) P.T. MAINT. COST PER HR.	(7) H.P. REQ.	(8) POWER COST PER H.P. HR.
4-Sp H-S Drill	2,804	1.645	1.81				8	0.006
Vert. Tapper	127	1.645	1.81				1	0.006
1-Sp H-S Drill	1,847	1.645	1.81				3	0.006
PROPOSED EQUIP.								
3-Sp H-S Drill	4,309	1.645	1.81				3	0.006

FACTOR	PRESENT EQUIPMENT	PROPOSED EQUIPMENT
(2) DIRECT LABOR (COL. 1 x COL. 2)	$ 7,876.27	$ 7,090.31
(3) MFG. BURDEN (1 x 3)	8,666.28	7,899.29
(4) PERISHABLE TOOLS (1 x 4)		
(5) P.T. MAINT. (5 x 6)		
(11) POWER (1 x 7 x 8)	168.65	77.34
GROSS VALUE OF EQUIPMENT		5,747.00
(10) PROPERTY TAXES & INSURANCE		57.47

OTHER FACTORS - DETAIL OF COMPUTATION:
$856. + $533. + $1156. = $2545. total machine repair (3) years
$146. + $101. + $ 339. = $ 586. total material cost (3) years
$2545. - $586. = $1959 total labor machine repair (3) years
$1959. x 150% = $2938 total labor and burden (3) years
$2938. + $586. = $3524. total cost and burden (3) years
$3524. ÷ 3 = $1175. total cost and burden (1) year (Machine Repair)

Repair costs are major items in Caterpillar's

ELLIOTT BREESE, manager of planning, PEORIA PLANT, CATERPILLAR TRACTOR CO

Replacement of wornout and obsolete production facilities has been the subject of intensive studies at the Peoria Plant of the Caterpillar Tractor Co in past years, concurrent with major expansion and retooling programs necessitated by the introduction of new and improved tractors and other products.

To assist Caterpillar's production planning engineers in these studies, a modification of the MAPI replace-

PRODUCTION OF TUBE LENGTHS was jumped 27.5%, machine repair costs were virtually eliminated, and part costs were slashed when an old turret lathe was replaced with Caterpillar-designed unit (above) for cutting tubes from mill lengths of stock, and chamfering both ends. New unit makes 115 pieces per hr, turret lathe production was 90 pph when finishing tubes purchased cut to rough lengths at higher prices

EQUIPMENT REPLACEMENT ANALYSIS

ANALYSIS OF THE JOB	PRESENT EQUIPMENT ANNUAL COST	PROPOSED EQUIPMENT ANNUAL COST
(1) MAKE OR BUY ANALYSIS	$	$
(2) DIRECT LABOR	7,876.27	7,088.31
(3) MANUFACTURING BURDEN	8,666.28	7,899.29
(4) PERISHABLE TOOLS		
(5) PERISHABLE TOOL MAINTENANCE		
(6) MACHINE REPAIR	1,175.00	50.00
(7) SUPPLIES		
(8) SCRAP		
(9) DOWN TIME AT $_____ PER HOUR		
(10) PROPERTY TAXES & INSURANCE	0	57.47
(11) POWER	168.65	77.86
(12) OTHER MANUFACTURING FACTORS		
(13) COST OF NEW JIGS, FIXTURES AND DIES $_____		
(14) PRORATION OF TOOLING OVER EQUIPMENT SERVICE LIFE (13 ÷ 18)		
ANALYSIS OF PRESENT EQUIPMENT		
(15) LOSS OF SALVAGE VALUE NEXT YEAR	70.00	
(16) PRORATION EXPENSE ADDITION $2,000 - 5 years	400.00	
ANALYSIS OF PROPOSED EQUIPMENT		
(17) COST INSTALLED $5,747.00 (g)		
(18) SERVICE LIFE 15 YRS.		
(19) TABLE PERCENTAGE 10.6 % (E)		
(20) ANNUAL CAPITAL COST (g x E)		609.18
(21) ANNUAL OPERATING COST	$ 10,356.20 (C)	$ 15,781.91 (P)
(22) AVERAGE ANNUAL GAIN FROM REPLACEMENT (C - P)	$ 2,574.39	

FLOOR SPACE GAINED FROM REPLACEMENT 23 SQ. FT. Only base of machines considered. This floor space is needed for addition of (2) radial drills.

FLOOR SPACE LOST FROM REPLACEMENT _____ SQ. FT.

ANALYST C. W. Rockwell

PROJECT VERIFICATION

PART NO.	OPER. NO.	REQMTS. PER YEAR	PROJECT BASE TIME	PROJECT ANNUAL BURDEN HRS.	ACTUAL BASE TIME	ACTUAL ANNUAL BURDEN HRS.
88163	3	9,998	0.00522	52		
1HD661	7	44,825	0.036	1,614		
5DL251	3	8,732	0.0039	34		
2B7114	1	39,718	0.00918	365		
6F5029	5	6,316	0.0117	74		
6F5797	2	1,505	0.02727	41		
4F7033	2	18,559	0.02538	471		
4F5768	2	33,208	0.03096	1,028		
			TOTAL (P)	3,679	TOTAL (A)	

RATIO OF PROJECT ANNUAL BURDEN HOURS TO ACTUAL ANNUAL BURDEN HOURS (P ÷ A) _____ (G)

FACTOR	PROJECT VALUE (R)	ACTUAL VALUE (R ÷ G)
DIRECT LABOR	$	$
MANUFACTURING BURDEN		
PERISHABLE TOOLS		
POWER		
TOTAL	$ (D)	$ (C)

EFFECT ON AVERAGE ANNUAL GAIN FROM REPLACEMENT (D-C) $_____

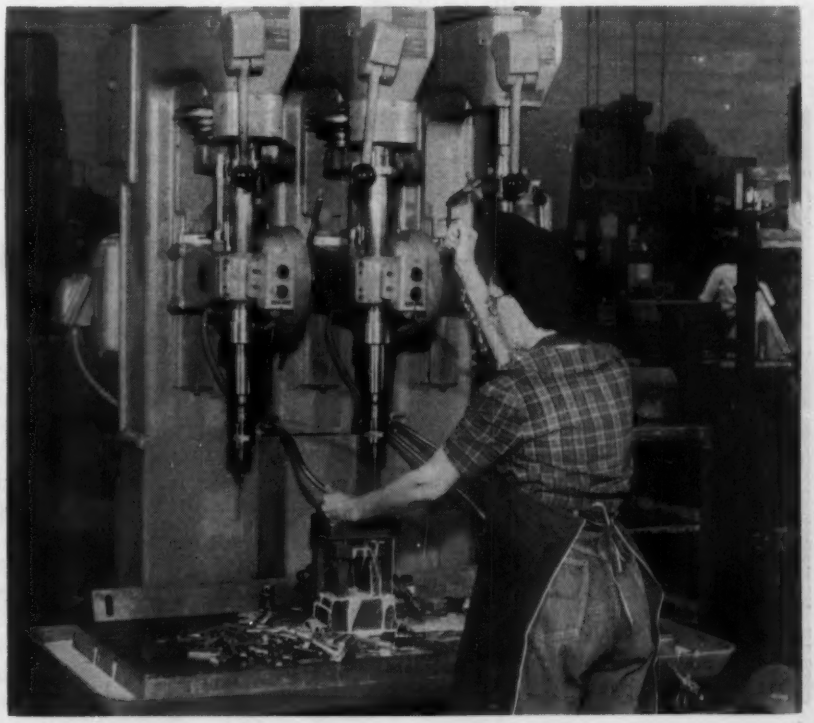
DISPOSITION OF OLD EQUIPMENT:

THE REPLACEMENT ANALYSIS FORM currently being used in the Peoria Plant consists of four pages. It is prepared as shown by the responsible planning engineer, and is submitted with a **Project Request** for management approval. Later, when the machine is installed, data covering the new machine are added at the bottom of the first page. A year or so later, management and/or the Accounting Department may request completion of data on the last page of the form, as a check against the accuracy of the original estimates. These control analyses are expected to insure conservative estimates when replacement studies originally are made. Values shown above are synthetic

replacement analyses

ment analysis form has been devised. It is employed when analyzing proposed replacements of old equipment.

The form has not been found applicable when analyzing the purchase of new production facilities to (1) provide additional production capacity, (2) improve manufacturing methods, or (3) make possible the production of new or improved models due to engineering improvements. In such cases,



ANNUAL MACHINE REPAIR CHARGES of approx $1,125 were saved when this 8-spindle drillpress replaced two old drillpresses and a tapper used to finish parts in a miscellaneous parts-machining line at the Peoria Plant. The machine was estimated to pay for itself in approx 2 years, and made it possible to provide space for two badly needed radial drills. Details are listed in accompanying analysis form

PLEASE TURN PAGE

REASONS FOR REPLACEMENT OF OLD EQUIPMENT

1. **QUALITY CONTROL**
   - A. Does machine produce within specifications?_____
   - If no — why doesn't it?_____
2. **BURDEN (MACHINE LOADING)**
   - A. If burden is low, have you routed precision jobs to other machines?_____
   - B. Will new machine absorb extra burden from other machines?_____How much? _____
3. **OBSOLETE MACHINE**
   - A. No longer manufactured?_____
   - B. Parts not available?_____
4. **REPAIR COSTS**
   - A. Overhaul cost?_____
   - B. Overhaul and downgrade to lighter work?_____
   - C. Sell machine?_____
   - D. Scrap machine?_____
5. **HORSEPOWER CAPACITY**
   - A. Capacity of old machine?_____
   - B. Capacity of new machine?_____
   - C. Percent gain on new machine?_____
6. **TOOLING**
   - A. Will new machine require partial, complete, or no new tooling?_____
7. **TIME STANDARDS**
   - A. Does old machine capacity meet time stands?_____
   - If not—why doesn't it?_____
   - B. Efficiency of old machine in percent_____
8. **SERVICE LIFE**
   - A. Has old machine reached or passed its service life?_____
   - B. What is its present age?_____
   - C. Estimated service life?_____
9. **MOVING EXPENSE**
   - A. Does new machine require rearranging building, or major line rearrangement?_____
   - B. What will be the cost?_____

DESPITE REPAIR CHARGES averaging $2800 annually per machine, two 25-yr-old gear shapers would not consistently hold required tolerances, nor could they keep up with production requirements. Their repacement with this modern 7½-hp gear shaper resulted in a 62% reduction in machine hours needed to produce the required number of flywheels, and reduced costs 43% during first year of use. Repair costs of other old machines are being studied

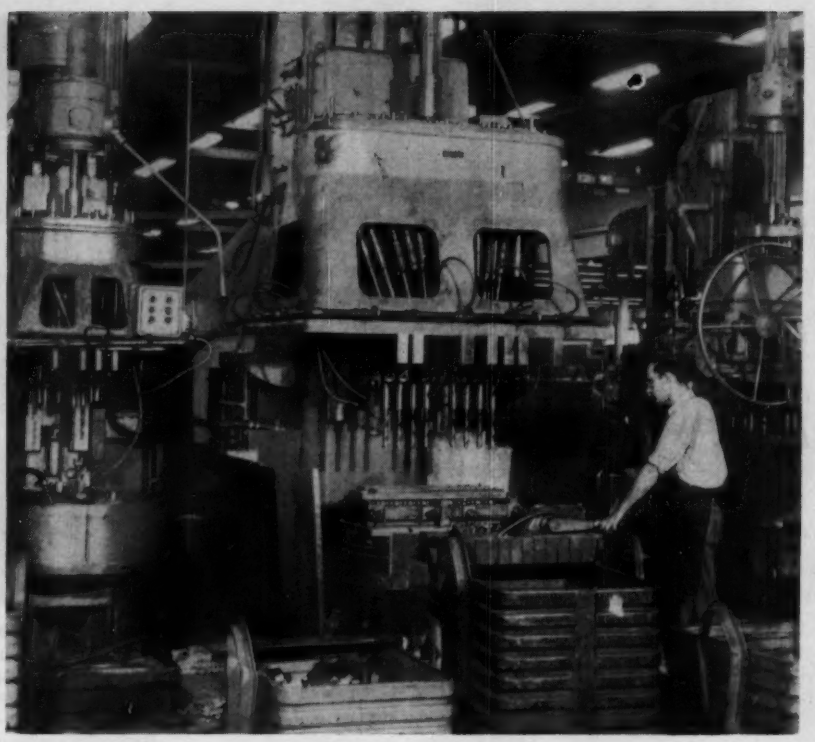
more detailed individual studies generally are needed.

While we realize that replacement of older machine tools with units of more modern design often will result in improved work quality, reduced downtime from stops for tool changes or repairs, and/or reduction in scrapped workpieces, it usually is difficult to assign monetary values to these gains.

On the other hand, we do have fairly complete records of machine-tool repairs and overhauls and we can, without difficulty, review the maintenance cost of any production unit. We also can determine accurately the cost of operating the individual machines, and the cost of the power required to drive them.

These factors, therefore, are the principal ones considered when preparing an equipment replacement analysis (see form). The other factors also have a bearing on the final decision as to when a machine should be replaced. But they will not be included in the replacement analyses until means are found to measure them more accurately.

This does not mean, of course, that a machine will not be replaced when it cannot meet quality or production efficiency standards, just because a lot of money has not been spent on its maintenance. Rather, it means that a more thorough study will be made of those cases after the replacement analyses have been reviewed. In fact,



THIS LARGE HEAVY-DUTY MULTIPLE-SPINDLE DRILL is used to drill, ream, spot-face and countersink a wide variety of miscellaneous parts. Recently installed, it replaced a 17-yr-old unit that would have required a $3300 overhaul to put it in usable condition, despite repair charges averaging more than $1600 annually during the last four years it was in service

one of the first questions studied when replacement of an old machine has been proposed is the *quality history* of the machine (see table).

Studies of the cost of repairing and overhauling older machine tools in recent years have shown us that this factor can add materially to factory operating expenses. We have, therefore, set up a special group of engineers in the Planning Department to maintain a continuing review of these costs, both to replace machines too expensive to maintain, and to determine, if possible, which types and makes of machine tools have a bad maintenance history. We anticipate that continuation of these studies will permit us to determine what elements in machine-tool design can be considered *accident prone* from a maintenance viewpoint. We then will be in a better position to determine design features to request when purchasing new machine tools, or when designing special machines to be made in our own shops or purchased to our specifications.

PERCENTAGE RETURN TABLE

SERVICE LIFE (YEARS)	ANNUAL COST (PERCENTAGE)	SERVICE LIFE (YEARS)	ANNUAL COST (PERCENTAGE)
5	31.8	13	12.2
6	26.5	14	11.3
7	22.7	15	10.6
8	19.4	16	9.9
9	17.6	17	9.3
10	15.9	18	8.8
11	14.4	19	8.4
12	13.2	20	7.9

Note: The percentage figures listed above include allowances for obsolescence and deterioration. These allowances are built into the values by shortening the Service Life 37% and using a straight-line return on the shortened life.

Example: 10 years x 0.63 = 6.3 years
1.00 ÷ 6.3 = 15.9%

New methods (2) take, then make, two jobs

Frank Dedek, methods research supervisor at Burroughs Corporation, Detroit, worked out an ultrasensitive electronic sound gage after he had developed an automatic machine for an assembly line that threw two blind girls out of work. Fellow engineers kidded Dedek about being "heartless" for eliminating the girl's jobs, she set about creating a method of gaging that could be done by the blind.

The gages are adapted to a sound amplifier. Those in use at Burroughs measure accurately to 0.0002 in. Operation is very simple; the worker inserts parts into a measuring anvil; if the part is undersized, a low-pitched tone sounds in a tiny ear phone. An oversized part registers as a high-pitched tone. Parts meeting requirements produce no sound at all.

Basically, the principle is very simple. Dedek adapted a gage so contact points in the meter hit a stop for oversize or undersize and, upon hitting the stop, closed a switch that sounds the proper note. A wide range of tones was tested and two melodic notes were chosen as the most pleasant. Although no further research on adaptation to other measuring devices has been done as yet, engineers who were queried on the principle see no reason why multiple gaging of larger parts cannot be accomplished, using the notes of the standard musical scale.

Most gages used in industry can be easily adapted for blind workers at a relatively low cost. Training in the use of the device takes approximately five minutes.

Mechanized heating puts brazing on the production line

Keeping step with other metalworking processes, brazing has progressed from a slow, manual operation to a fully mechanized procedure. Here are some typical setups

REFRACTORY GAS-AIR BURNERS used with automatic brazing machines —burners illustrated produce spot (right), localized heat (center), or broad uniform heat coverage (left)

CHARLES A McFADDEN, project engineer, SELAS CORP OF AMERICA, PHILADELPHIA

Assembly by brazing has become an important production technique because of its speed, efficiency, and economy. Complicated parts can be built up step by step from relatively simple stampings, forgings, castings and screw-machine parts. In many cases, the finished assembly represents a shape which cannot be fabricated by any technique other than brazing.

This joining method has been integrated into the production line by means of a new heat-processing tool, the Selas automatic brazing machine. This machine utilizes high-speed gas heat, combined with mechanical handling and timing devices, to produce uniform assemblies at a production rate as high or higher than most metal-forming operations.

Use of inexpensive city gas, natural or manufactured, and elimination of manual operations, combine to make the process economical. Further savings are effected in fuel cost and floor space requirements by localizing heat application to the brazed joint area, instead of heating the entire workpiece, thus avoiding bulky furnace construction.

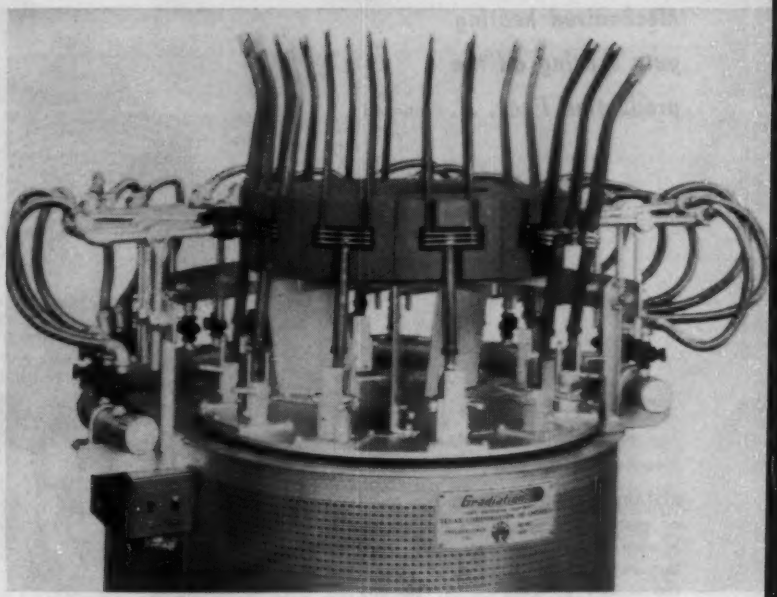
In practice, heat is delivered by one or more refractory-type gas-air burners while the work assembly is held in an appropriate fixture. Automatic fuel carburetion by means of a gas Combustion Controller develops constant heat-release rates at the burners; time of exposure to the high-temperature gases is also controlled closely to produce exact duplication of heat cycles, piece after piece. Prefluxing and preplacement of brazing alloy assures ample filler metal in every joint without waste. Mechanical control of process variables, such as heat placement and heating time, permits an unskilled operator to produce hundreds of assemblies per hour with virtually no rejects or rework.

Thorough premixing of the fuel gas and air, combined with the use of refractory burners, results in extremely fast heating—minimizing problems of flux breakdown, joint-area oxidation, and liquation or preferential melting of alloy ingredients in some brazing metals. Hot, fully burned gases surround the workpiece to exclude room air, thus prevent scaling of the brazed joint areas.

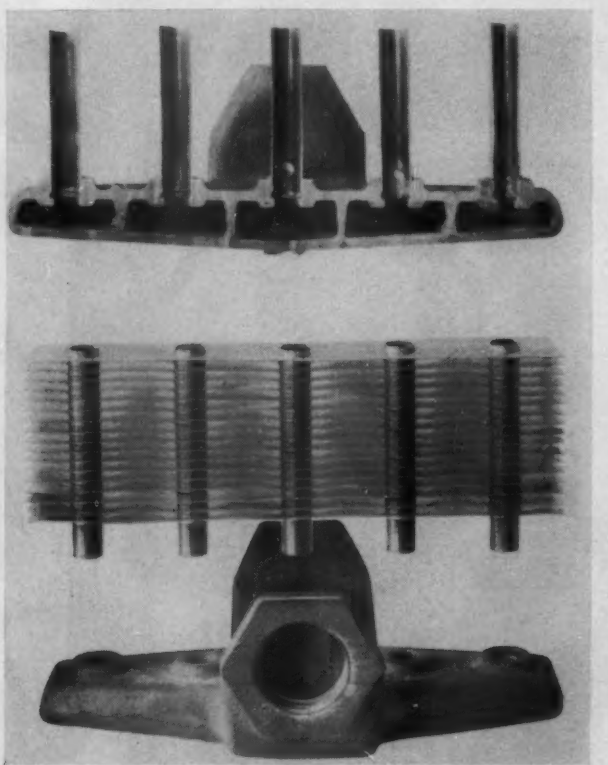
While this precision in process control is reflected in the high quality of machine-brazed assemblies generally, it is most strongly indicated in the high degree of success in brazing aluminum. In numerous cases, aluminum assemblies are brazed at high production rates with alloys which flow within 50 F of the melting point of the parent metal. Split-second timing and exact control of heat release rates are required to prevent burning of such parts. Under similar conditions, manual brazing would be virtually impossible.

Controlled cooling after brazing is generally incorporated as a machine function, sometimes to simplify assembly handling, and in other cases to develop desired physical properties in the workpiece. For example, the socket-wrench assembly shown utilizes a forged SAE 4047 steel socket brazed with 1500 F filler metal. Immediately after the last brazing position, the socket is quenched with a blast of compressed air to develop a hardness of approximatetely 50R_c, thereby imparting toughness and wear resistance to the forging.

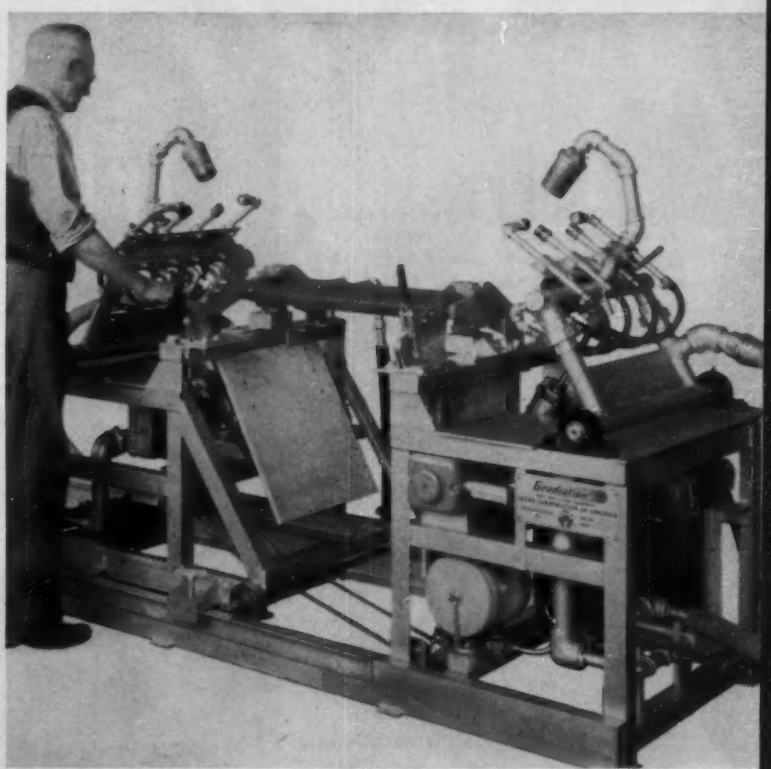
ALUMINUM-SHEATHED electric heating element is placed with preformed length of brazing alloy on the upturned bottom of an aluminum coffee pot. Automatic brazing produces a solid joint between heating element and container, increasing utensil efficiency by as much as 400%. Several different thicknesses of aluminum are heated to 1050 F for brazing in less than 30 sec



BICYCLE FORK SECTIONS are loaded on this machine at front station, carried by an intermittently moving dial past six heating stations. Total heat cycle of 72 sec brings brazing alloy to flow temperature of 1750 F. Complete assemblies then move to unloading station where they are tilted forward out of the refractory heat reflectors to facilitate unloading. Production is 300 per hr



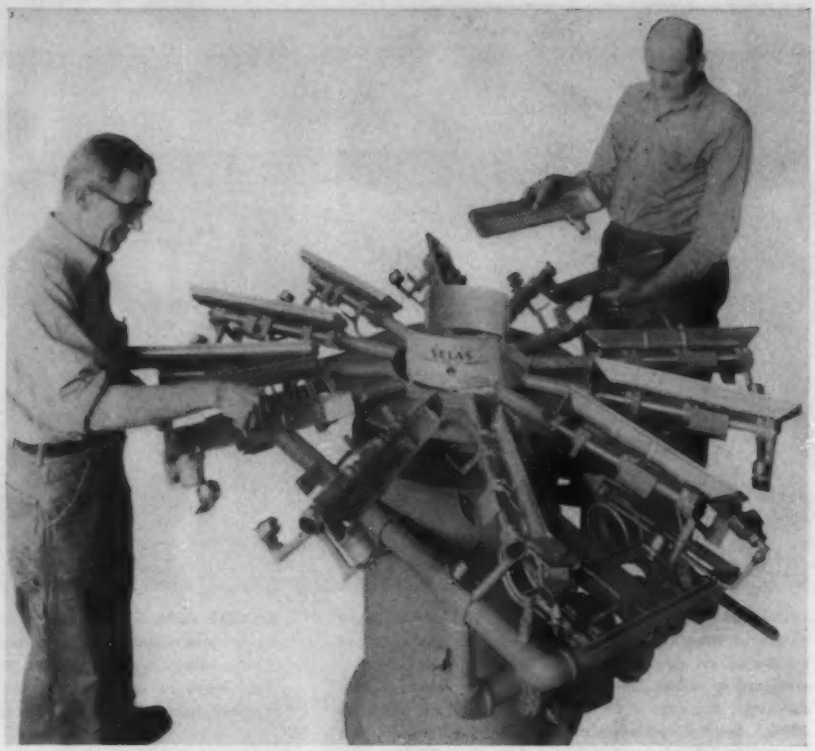
BRAZING COPPER TUBING to cast-iron end pieces of convector-type room heater presents a difficult problem in heat balance. Heavy iron header and thin tubing must be brought to brazing temperature at the same instant—overheating by only 50 F will melt the aluminum fins. Brazing alloy is preplaced in the grooves visible in the upper view



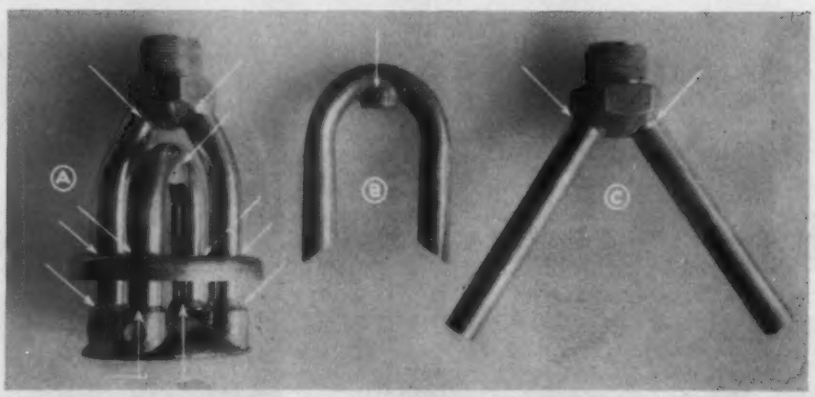
CONVECTOR BRAZING operation is performed in this semi-automatic machine. Iron header at each end is heated by four small burners while tubes are heated internally by large burner which directs the flame into the large port in the casting. Once work has been set in place, push-button control lowers the burners into position and turns them up to high fire for a 2½-min brazing cycle

PLEASE TURN PAGE ▶

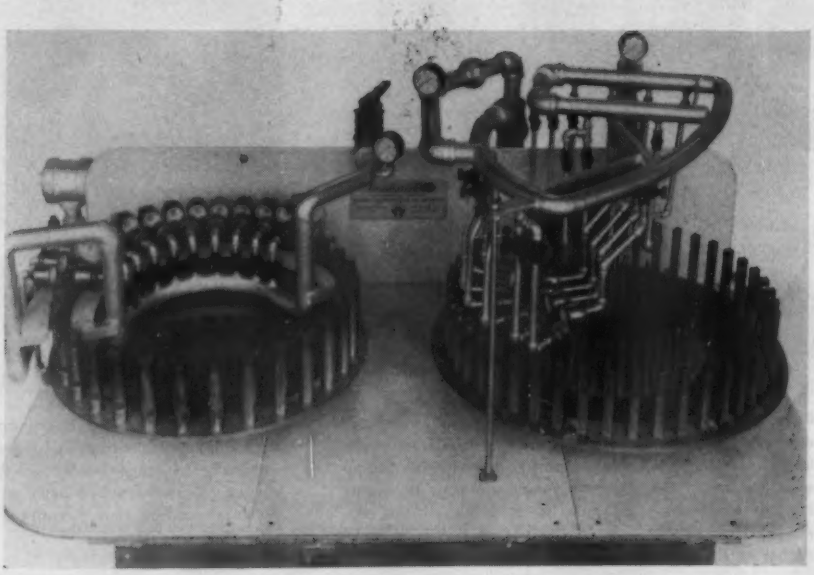
Mechanized heating puts brazing on the production line . . . continued



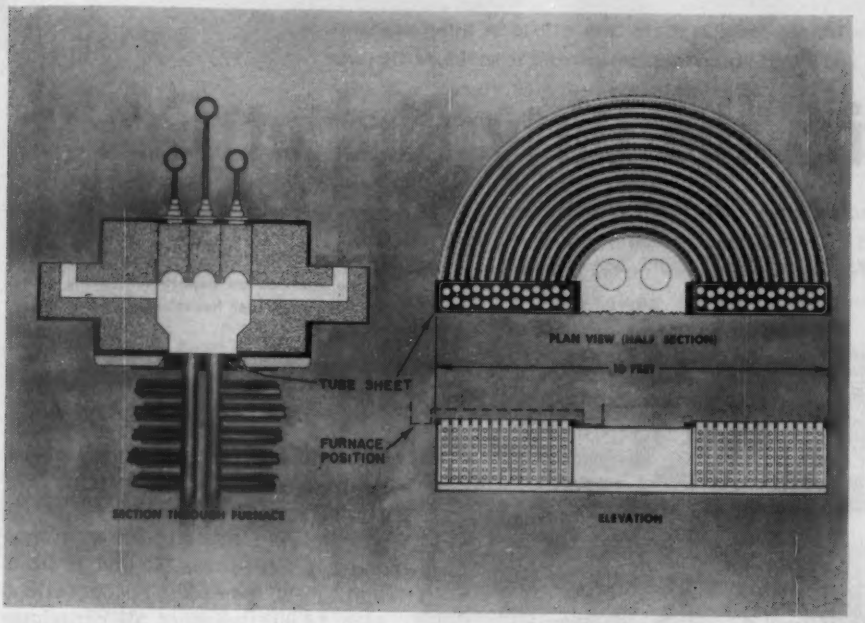
ROTARY MACHINE silver brazes one joint on each of two assemblies simultaneously. Worker at left loads automobile radiator bottom pieces for brazing of outlet hose connections at three burner stations on far side of dial. Worker at right unloads finished bottoms and loads top assemblies for brazing at two heating stations in foreground. Dial with 12 sets of dual fixtures indexes one position each 13 sec. Operators produce 550 assemblies per hr



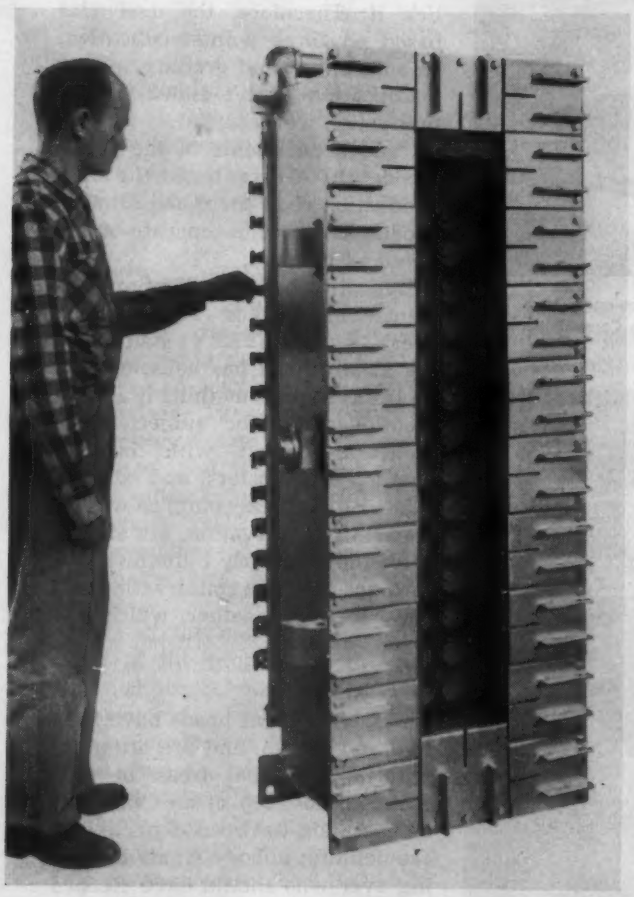
ELEVEN JOINTS, seven of them gas-tight, are machine brazed to form the complex assembly shown at *A*. Joints *B* and *C* are brazed first; the ends of the tubing are then brazed into the base while the supporting ring is brazed to the tubes to complete the assembly



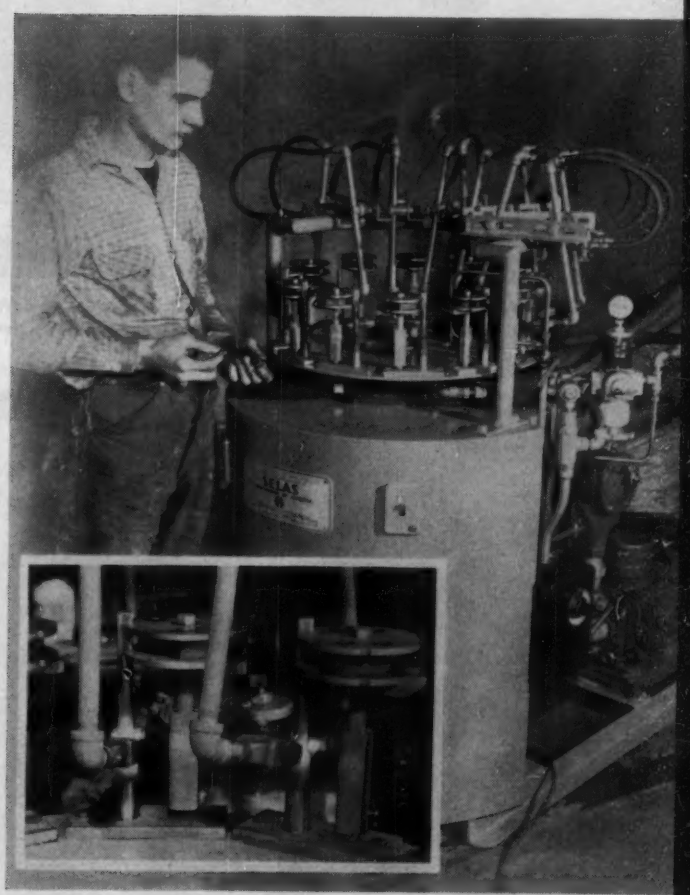
OPERATIONS ARE PERFORMED on a single brazing machine at a total of 5940 joints per hr. Joints *B* and *C* are handled on RH turntable while remaining eight joints are completed on LH table. 46 burners are used to braze 540 complete assemblies per hr



HEAT EXCHANGER of a mammoth refrigerator machine. 2-in.-dia copper tubes must be assembled by brazing into 1½-in.-thick steel tube sheets. High-speed heating is necessary to overcome the tendency of the heat-exchanger assembly to draw heat away from the brazing area



PORTABLE SEMI-FURNACE containing 45 burners is placed over the tube sheet to develop 1½ million Btu per hr at temperatures up to 2400 F. Each burner is individually valved to permit balancing heat input, and all are supplied with premixed gas and air from a Combustion Controller. Tube sheet and tube assembly reach brazing temperature of 1145 F in less than 5 min, brazing all 26 tubes simultaneously



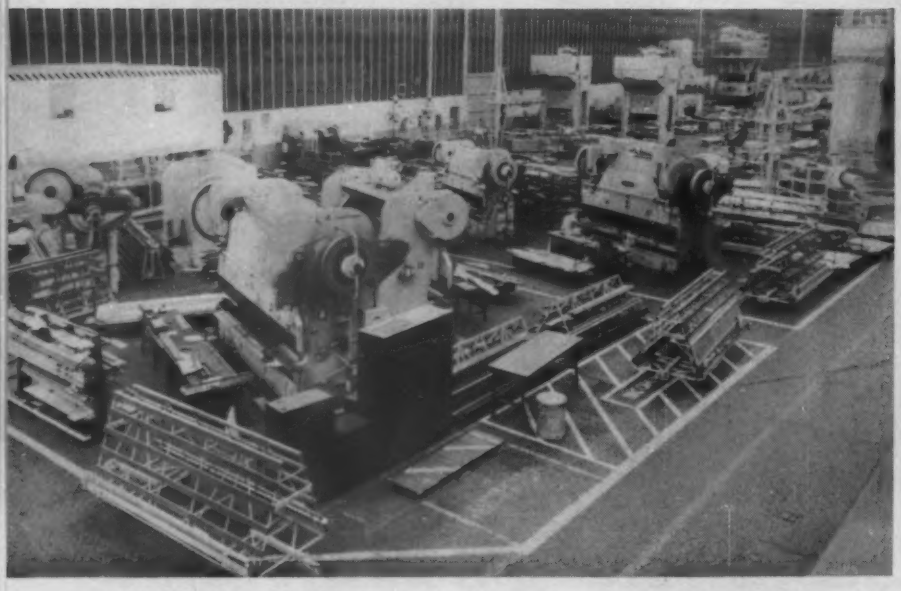
SILVER BRAZING is combined with flame hardening of a socket-wrench assembly. Workpieces are supported with the shanks vertical in special magnetic fixtures attached to an indexing-type turntable. A compressed-air blast immediately after the last of six heating stations hardens the socket forging. All necessary operating accessories are mounted on the machine base to produce a complete package design. Installation requires only connection to shop compressed air, fuel gas, and power lines

The War with the Dirty Bird at GAP-6

LES D MYERS, plant engineer, LOCKHEED AIRCRAFT CORP, MARIETTA, GA

"DIRTY BIRD" is an award made inside the modification department to the group with the worst housekeeping record

B-47 FINAL-ASSEMBLY LINE is busy, not messy. Ship is a Boeing design, being built by Lockheed, too, to get them out in a hurry. Plant also produces C-130A Hercules Combat transports



PRESS AREA IS WELL MARKED, with wide aisles, plenty of space between machines. Special stock racks are wheeled for easy mobility. Large cabinets at side of press brake are called hiboys; store tools

First off, Lockheed's management realized that no one person, or any group, could crack the clean-up whip at the whole working force and get top results. It had to be a matter of complete cooperation, with 16,000 workers all conscious of the problem and cooperating to lick it. Therefore, the deal was based on three points: education, responsibility, and grading.

Education wasn't aimed just at production workers, but at all levels and departments in the plant. Besides the 76 acres under the main production roof, there are 23 more production acres in separate buildings and hangars.

Education had to be kept up constantly, and still is. For example, every (repeat: EVERY) staff meeting at any level has housekeeping on the agenda; something is always mentioned on the subject. The plant is loaded with bulletin boards, and posters and slogans related to housekeeping, as well as materials conservation, are always on display. Weekly bulletin-board cartoons often tie conservation and housekeeping together, which is a logical alliance.

RESPONSIBILITY

All department heads have been told and shown, and are often reminded, just what areas they are expected to keep clean. Lines of demarcation between departments are definite; nobody wants bickering over who should have cleaned up what, but didn't.

Early in the program, the organizing necessary to start the campaign turned up a lot of unused equipment that was just lying

Housekeeping is pretty dull stuff at most manufacturing plants, but 16,000 aircraft builders at Government Aircraft Plant No. 6, operated by Lockheed, take it seriously. Because cleaning up has been a major issue for the past year and a half, they can report:

- **Fewer lost parts—they stock 200,000 kinds, so this item isn't exactly peanuts**
- **Less tool damage and loss — in 35 production and tooling departments**
- **More productive space made available — GAP-6 is the largest aircraft plant under one roof (76 acres) but they can always use more space**
- **Faster traffic flow — along 4½ mi of 2-lane aisles**
- **Better morale throughout the plant**

How they did it shows the reasons why the plant is well on its way in becoming the cleanest plant in the industry . . . .

around; this was relocated to open up valuable working space. At the same time, a concentrated fire-inspection program was started up; and this helped direct attention to the value of good housekeeping.

Housekeeping must be enforced, and to do this each department has a committee of up to ten employees, who serve in rotation. Each committee inspects, calls attention to rule violations, and sees that the responsible personnel clean up the mess.

GRADING

A complete grading system for comparing departmental housekeeping makes a competition out of it. Not too long ago the system was revised. The plant is considerably cleaner now than it was a year ago, and it's difficult for a really outstanding department to distinguish itself. Now the grading is tougher. A department can still make 100%, but it takes a bit of doing.

One of the most dramatic features of the program is the way in which inspections are made. The housekeeping coordinator walks into a department foreman's office once a month, on a random date, and announces that he is making an inspection. He starts off immediately, with the foreman in tow, carrying his checklist of 37 items, on which he marks down any visible violations. There's no warning to anyone, so he gets a good idea of the way the department looks all month long. Management considers this inspection without warning the single most important factor in housekeeping enforcement.

After the inspection, a grade for the department is computed, and a report is made to the foreman, the division manager, and the production manager. In addition, the housekeeping coordinator makes spot checks each day, often walking as much as 20 mi/day around the plant.

Rewards for the employees are mainly in pride. The Hercules Trophy, which is in plant-wide competition and goes to the best department for a month, is a beauty. Not so some of the other awards, which are handed back and forth weekly between groups within departments. Two examples are the Gold Bricker and the Dirty Bird, neither of which are happily accepted by the most-offending groups.

MORALE IS UP

The working force evidently considers the program worthwhile, because plant-wide morale is better than before the program was started. An outstanding example is the janitorial force, not usually a breeches-busting group in most plants, but at GAP-6 a gang with top morale. Part of the reason is the general program, which put the janitors somewhat in the spotlight; but another reason is the new "methodized" approach. About half the janitors were taken from the plant engineering div and assigned to production departments, where they were made responsible for general conditions.

Then they were trained; in the best step-by-step methods, and in

HERCULES TROPHY (for the new C-130A) goes to department with best monthly housekeeping record

"GOLD BRICKER" is the machine-shop division's blessing on the record of the worst section each week. The "24-K gold brick" is burnished copper

BUTT CANS are made in the plant; the tiny top opening discourages flippers effectively

using mechanized equipment, like mechanical wall washers, waste conveyors, and vacuum cleaners. The best janitors taught by example, and eventally methods got good enough to be put on a schedule. Now, each janitor has a time chart with his assignment, route, and a list of how long each job should take—and he sticks to it.

There is no longer any overlapping work, because areas are assigned, and each janitor knows his area. The result is that janitors have an absence rate that approaches zero.

STILL SOME TO GO

Parking areas, stairways, rest areas, and streets aren't assigned to any specific departments, and there are many cases of littering in these places. The plant-engineering staff keeps after them, but evidently the matter of responsibility makes a difference. Right now the the housekeeping staff is trying to beat this part of the problem with education, but it isn't hurdled yet.

But on the whole the housekeeping program has been successful, and it's turned up three big advantages:

1. Maximum mechanization and methodization of housekeeping has allowed a thorough job without an increase in personnel.

2. Housekeeping responsibility has reduced the amount of supervision necessary, and has improved final results.

3. Training and education involved in the program have paid off in cooperation and efficiency.

HOUSEKEEPING INSPECTION WORK SHEET

Dept. _____
Date _____
Prod. Foreman _____

Aerosol paint cans misplaced	1
Aisles littered	1
Ash tray cans misused	1
Bench drawers disorderly	1
Bench shelves disorderly	1
Bench tops disorderly	1
Bulletin Boards—obsolete notices	1
*Butt cans dirty, smoking	1
Butt cans misplaced or without tops	1
*Cigarette butts on floor—each	1
Coffee cups not in trash cans	1
Coke bottles not racked	1
Column bases dirty—each	1
Drinking fountain—dirty	1
File drawers disorderly (each drawer)	1
*Fire equipment blocked—other fire hazards	5
Floors—accumulated dirt	1
Hiboy tops disorderly	3
Hiboy drawers disorderly	2
Matches—each—wooden	1
*Mercuries—misaligned, misloaded	1
*Mercuries, gondolas littered	1
*Office areas disorderly	3
Old newspapers	1
*MSP, clecos—excessive, improper storage	3
*Parts, assemblies—on floor, in drawers	2
Parts, assemblies—poor handling, storing	2
Salvage containers contaminated	3
*Sealing compound and paint cups—dry	1
Signs—improper or obsolete	1
Stockracks, Rotabins, etc. disorderly	1
Streets, aisles—blocked—each mercury	2
Tools—poor storage	2
*Tote pans misused	1
Trash cans—excessively dirty	1
Work areas littered	1
Work—dirt—excessive	1

* Revised January 1955

Dept. Head Count _____ Total Points _____
Severity Rating _____ Order Rating _____

CHECKLIST FOR HOUSEKEEPING INSPECTOR covers just about everything possible. Marked items were added or revised Jan '55

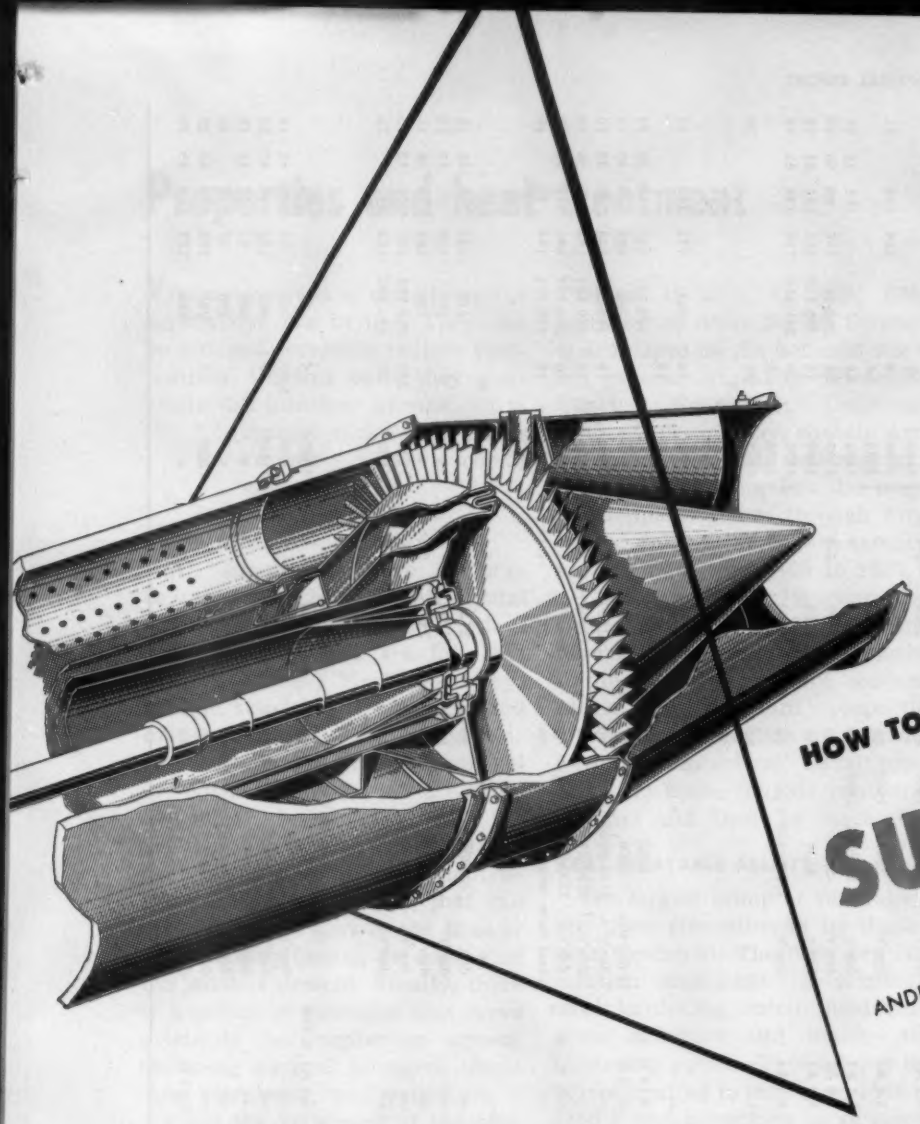
HOW GAP-6 HANDLES INDUSTRIAL WASTES

TYPE	DISPOSAL
MSP (misc small parts) 2 ton/mo	Dumped in locked barrels by workers at end of each shift; cleaned and re-sorted by Georgia Factory for the Blind; reused at GAP-6
Acid & caustic chemicals	Titrated in receiving pools to neutralize them, then dumped into Chattahoochee river
Trash, refuse, butts	Collected from hooded cans, trucked to incinerator, and burned
Chips from machines	Salvaged as scrap metal after separation
Waste oil	Burned
Soft-drink bottles (thousands daily)	Racked and returned to bottling company

ALL WASTE is handled according to best method, never just dumped or swept out

American Machinist

SPECIAL REPORT NUMBER 407



HOW TO WORK superalloys

ANDERSON ASHBURN, special projects editor

The search for materials that would have useful properties at elevated temperatures was started to find tools that could be used at higher speeds. Thus, the first high-speed steel came into existence in 1880, and the familiar, basic 18-4-1 composition was developed in 1903. Taking a different approach, Elwood Haynes patented his first cobalt-base metal in 1907.

New needs arose with the turbosupercharger and later with the aircraft gas turbine. Today the heat barrier looms before every aircraft and stationary turbine builder, and there are other industries likely to encounter the barrier soon.

Supralloys are the varied group of metals developed to retain strength at operating temperatures above 1200 F. Much has been written about the metallurgical properties of these alloys, but there has been limited experience and even more limited data on working them — most of it describing a single alloy and of little use to a plant encountering a newer alloy of largely unexplored characteristics.

This Report is a pioneering attempt to assemble and correlate for practical shop application such data as has been developed. As with American Machinist's early Reports on aluminum, magnesium, titanium, and zirconium, the data here are preliminary in many cases. As improved or simplified practice is developed, this Report will be supplemented or revised. Meantime, the practice described here can serve as a starting point in solving fabrication problems with superalloys in your plant.

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TYPICAL COMPOSITION, TREATMENTS, AND PROPERTIES OF SUPERALLOYS

Alloy	C	Fe	Cr	Ni	Co	Mn	Si	Mo	W	Cb	Ti	Other	hot-cold work, °F	forging, °F	minimum °F	stress relief °F	stress relief hr	solution treat °F	solution treat hr	age harden °F	age harden hr	Brinell hardness	Tensile, Mpsi 70 F	Tensile, Mpsi 1200 F	1000 hour stress-rupture 1200 F	1000 hour stress-rupture 1500 F
WORK-HARDENABLE SUPERALLOYS																										
EME	0.15	63	19	12	—	0.5	0.5	—	3.2	1.0	—	0.15 N				1200	4+	no		no		250-300	130	84	42	—
G-18-B	0.4	55	13	13	10	0.8	1	2	2.5	3	—	—				1200	4+	no		no		290	107	69	35	13
Haynes No. 88	0.08	67	12.5	15	—	1.5	0.5	2.25	0.6	—	0.6	0.015 B				no		no		no		220-255	105	71	49	16
19-9 DL	0.15	66	19	9	—	1.1	0.5	1.4	1.4	0.4	0.2	—	1200	2150	1200	1200	4+	1800-2150[a]		1200-1400[a]		228-227	155	98	38	10
Timken 16-25-6	0.08	51	16	25	—	1.5	0.5	6.0	—	—	—	0.15 N	1400-1200	2100	1200	1200	4+	no		no		235-293	140	89	34	9
HEAT-TREATABLE SUPERALLOYS—titanium group																										
A-286	0.05	53	15.5	26	—	1.35	0.95	1.25	—	—	1.95	0.32V	don't	2150-2000	1700	no		1800	1	1325	12	300	146	104	48	8
Discaloy 24	0.03	54	13.5	26	—	0.8	0.8	3	—	—	1.6	0.1 Al	don't	2100-1950		no		1850	1-3	1350 1200	20 20	248-302	145	104	44	8
K-42-B	0.03	14	18	42	22	0.7	0.7	—	—	—	2.1	0.2 Al	don't	2100		no		1950	1	1350	20	221-302	152	110	40	11
Inconel X	0.04	7	15	73	—	0.7	0.4	—	—	1	2.5	0.7 Al	don't	2225	1800	no		2100	2-4	1550 1300	24 20	262-341	162	120	68	18
Inconel X Type 550	0.03	6.5	15	73	—	0.5	0.3	—	—	0.6	2.5	1.1 Al	don't	2225	1800	no		2150	1	1600 1350	4 4		164	136		21
M252	0.17	1.5	19	54	10	1.1	0.7	10.9	—	—	2.2	0.5 Al	don't	2150-2050	1800	no		1950	4	1400	15			161	75	18
Nimonic 80A	0.05	0.5	20	76	—	0.7	0.5	—	—	—	2.3	1.0 Al	don't	2100		no		2100	2-4	1300	16	262-341	147	98	56	16
Nimonic 90	0.08	0.5	20	58	16	0.5	0.4	—	—	—	2.3	1.4 Al	don't	2100		no		1975	8	1300	16	248-310	165	132	64	18
Refractaloy 26	0.03	16	18	38	20	0.8	1	3.2	—	—	2.6	0.2 Al	don't	2100-1950		no		2100	1	1500 1350	20 5	241-311	154	136	63	18
Waspaloy	0.06	1	19.5	48	13.7	0.9	0.5	3	—	—	2.5	1.2 Al				no		1950	4	1375	16					20
HEAT-TREATABLE SUPERALLOYS—carbon group																										
CSA-39	0.15	40	18.5	27	—	1.2	0.5	9.3	3.3	—	—	—				no		2250	1	1250 1400	16 16	338	172	110		17
N-153	h	47	17	15	12	1.5	0.5	3	2.5	1	—	0.15 N		2200		no		2200	1	c		193-241	121	90	30	14
N-155	h	30	21	20	20	1.5	0.5	3	2.5	1	—	0.15 N	1650-1400	2200	1400	b	2-4	2150	1	c		266	135	90	40	13
S-588	0.5	46	18.7	20.3	—	1.2	0.8	4.2	4.4	4.2	—	—	don't	2150-2000	d	no		2200	1	1400	16	264-335	148	81	30	10
S-590	0.4	27	20	20	20	1.5	0.6	4	4	4	—	—	don't	2250-2100	d	no		2200	1	1400	16	269-341	142	95	38	16
S-816	0.4	4	20	20	41	1.5	0.6	4	4	4	—	—	don't	2250-2100	d	no		2200	1	1400	16	269-352	140	112	45	18
V-36	0.3	4	25	20	41	1.5	0.6	4	2	2	—	—	(sheet form only)			no		2275	0.25	1400	16	255-275	144	91		18
HEAT-TREATABLE SUPERALLOYS—tungsten-moly group																										
Hastelloy B	0.08	5	—	66	—	0.6	0.2	28	—	—	—	—	don't	2200		no		2150	1-4	c		215	135		41	13
Hastelloy C	0.1	5	16.5	56	—	0.6	0.2	17	4.2	—	—	—	don't			no		2250	1-4	c		247	130	87	43	15
Haynes No. 25 (L-605)	0.1	1	20	10	52	1.5	0.7	—	15	—	—	—	don't	2200		no		2200	0.16	c		256	155	75	58	17
Refractaloy 70	0.04	14	20	21	30	2	0.3	8	4.2	—	—	—	don't	2150		no		2250	4	1500	240	293-352	132	112	42	15
Refractaloy 80	0.1	14	20	20	30	0.6-2[i]	0.7	10	5	—	—	—	don't			no		2250	4	1600	20	325-385	162	101		16
CAST SUPERALLOYS																										
GMR 235	0.15	10	15.5	66	—	0.25	0.6	5.25	—	—	2	0.3 Al, 0.06B				no		2100	1	1800[g]	5			110		
Haynes No. 21 (Vitallium)	0.27	1	27	2	64	0.3	0.6	5.5	—	—	—	—	don't	don't		no		2200[e]		1500[f]	5-50	293	125	85	44	14
Haynes No. 23 (61)	0.38	1	25	2	65	0.3	0.6	—	6	—	—	—	don't	don't		no		no		1350[f]	50	304	133	98	47	22
Haynes No. 27 (6059)	0.42	1	26	35	31	0.5	0.4	6	—	—	—	—	don't	don't		no		no		c		200	91	63	46	18
Haynes No. 30 (422-19)	0.42	1	26	15	51	0.5	0.4	6	—	—	—	—	don't	don't		no		no		c		270	97	75		22
Haynes No. 31 (X-40)	0.5	1	25	10	54	0.6	0.7	—	7.5	—	—	—	don't	don't		no		no		1500[f]	16	280	113	74	46	23
Haynes No. 36 (L-251)	0.4	1	18.5	10	54	1.2	0.5	—	14.5	—	—	0.03 B	don't	don't		no		no		c		243	125	105	46	26

Properties and heat treatment

Various methods of classifying the superalloys are in use. They can be grouped according to their composition. On this basis they generally fall into four groups:

1. . chrome-nickel-iron alloys
2. . chrome - nickel - cobalt alloys
3. . nickel-base alloys
4. . cobalt-base alloys

All superalloys have a face-centered cubic or austenitic crystal structure. (The familiar alloys with this structure are the 18-8 stainless steels.) Most superalloys contain substantial chromium and nickel. Some have large iron content, but many do not, with nickel or cobalt serving as the base instead.

Other constituents include a group, such as tungsten, molybdenum, and columbium, that can serve either as part of the base or as hardening agents, depending on the amount present. Finally, there is a group of elements that serve primarily as hardening agents, including carbon, nitrogen, titanium, aluminum, and vanadium.

From the viewpoint of the production engineer, a more practical classification is by the method of heat treatment or hardening. The principal superalloys are listed in the table by this method. The alloys are divided into work-hardening, heat-treatable, and cast groups. Heat-treatable alloys are subdivided into titanium, carbon, and tungsten-moly groups. With this division, the shop practice for each group will follow similar lines.

WORK-HARDENING SUPERALLOYS

This first group is produced only in the wrought condition and includes such alloys as 19-9 DL, Timken 16-25-6, G-18-B, EME, and Haynes Alloy No. 88. Strength is developed by the hot-cold working process originally devised by Charles Evans at Universal-Cyclops. These alloys contain some hardening elements and may gain by heat treatment, but the major development comes through forging or rolling them in a temperature range from 1400 to 1000 F.

Good forgeability is characteristic of the work-hardening group, though the necessity of completing forging in the hot-cold working range for optimum properties makes the production of precision forgings impractical. Usual practice is to make roughly contoured forgings and finish by machining.

HEAT-TREATABLE ALLOYS

The largest group of superalloys are those strengthened by duplex heat treatment. The first step is a solution treatment to eliminate work hardening, obtain the desired grain structure, and dissolve the hardening agents. Typically, it involves heating to the range 1800 to 2350 F and quenching large pieces in water or oil, small, thin pieces in air.

The second step involves age hardening—precipitating the hardening elements by heating to some temperature lower than the solution-treating temperature. The level required varies with the different alloys and is an indication of the temperature range at which they can be used to best advantage. Some alloys develop their best high-temperature properties by a two-step aging procedure involving holding at one temperature, then changing rapidly to a second temperature (usually lower) and aging again. Temperature and time for each step are shown in the table.

The group hardened with titanium is age hardened from 1200 to 1550 F. Because of the titanium content they are not castable by present methods, and are available only in wrought form. Such iron-base alloys as Discaloy 24 and A-286 are similar to the work-hardening superalloys but are better suited for closed-die forging because they can be forged at higher temperatures, then strengthened by heat treatment.

The other titanium-hardened alloys include such nickel-base alloys as Inconel X, Inconel W, and Nimonic 80A, and such nickel-cobalt-base alloys as K-42-B, M-252, Refractaloy 26, and Waspaloy. They are tougher to fabricate than the iron-base alloys, but have a higher service temperature.

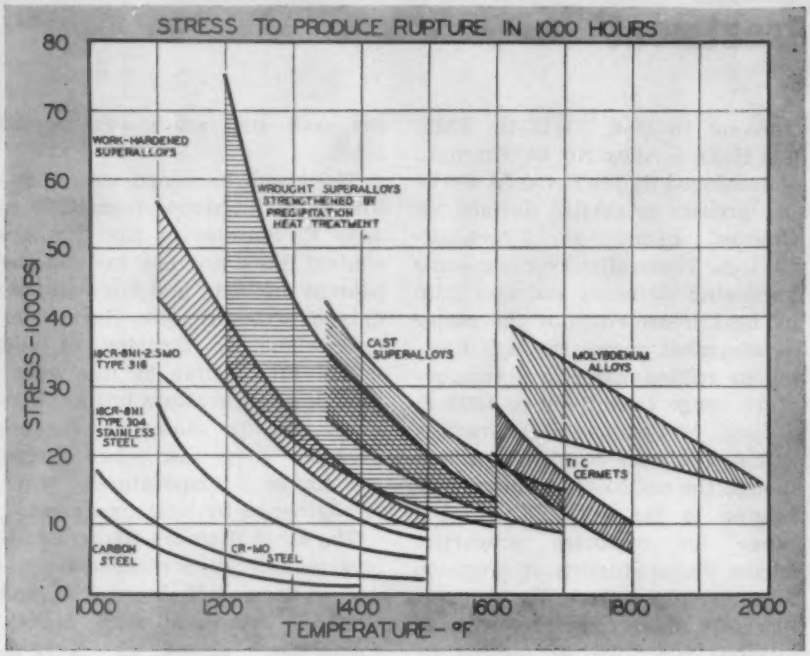
The remaining heat-treatable alloys can be cast if necessary.

The carbon-hardened group has a higher chromium content to offset the loss of oxidation resistance that would otherwise result from formation of chrome carbides. This group includes CSA-39, N-153, N-155, S-588, S-590, S-816, and V-36. Age-hardening range is 1200 to 1500 F, though the effectiveness varies widely with the different alloys. S-816 is widely used for turbine blades at service temperatures to 1550 F.

The third group is hardened with molybdenum or tungsten and will age harden in the range from 1500 to 1800 F. It includes such alloys as Haynes No. 25 (L-605), Refractaloy 70 and 80, and Hastelloy B and C. These alloys do not have as good properties as the others below 1500 F, but are better above 1500 F.

NOTES

a. 19-9 DL is not always age hardened, but this procedure is recommended for optimum long-time creep and rupture resistance above 1300 F.
b. Use maximum service temperature to be encountered.
c. Not usually given age-hardening treatment, but will harden in service in the range 1300 to 1800 F.
d. No hot-short range, but difficult to work at lower temperatures.
e. Not a solution treatment but an anneal. Fan cooling from this temperature will improve machinability.
f. Usually used as cast. This treatment will harden to some extent.
g. Aging from the as cast form without solution treatment is the preferred production procedure.
h. Two carbon ranges, 0.20 max or 0.20 to 0.40.
i. Low manganese for cast, high manganese for wrought material.



COMPARATIVE STRESS-RUPTURE PROPERTIES of the superalloys and other materials at high temperatures indicates approximate area of application for each

CAST SUPERALLOYS

The group of Haynes alloys used as investment castings are all hardened by carbon combined with molybdenum or tungsten. All are high in cobalt. They include No. 21 (Vitallium), No. 30 (422-19), No. 31 (X-40), and No. 36 (L-251). They are not usually heat treated but will harden in service from 1300 to 1700 F.

Wrought alloys commonly used also in cast form are N-153, N-155, S-590, S-816, and Hastelloy B and C. Refractaloy 80 was originally a cast alloy but is now also used in the wrought form.

A new cast alloy, developed for reduced strategic content, is GMR-235. There are indications that this alloy will profit from solution treatment for 1 hr at 2100 F followed by air cooling. Aging the solution-treated metal is of no advantage. However, aging as-cast GMR-235 for 5 hr at 1800 F has increased hot strength in the 1600 F service range and is the present production practice.

CONTROL OF PROPERTIES

The study of high-temperature properties of the superalloys is complex and has been extensively covered in metallurgical literature in recent years. A few typical properties are included in the table to give a rough indication of the nature of each alloy.

It is important for production men to realize that properties of superalloys can vary widely. One part may have a service life at a given high temperature that is ten times as great as another part made of the same alloy. Variations in composition are a partial cause, but the processing variables are a greater factor.

Thus all fabrication operations (even including machining) must be planned in relation to the heat treatment and the service requirements. Because they are austenitic, superalloys do not undergo a phase change in heat treatment and grain size is controlled by work hardening.

In the age-hardening alloys, the hardening phase can be precipitated during fabrication. Improper control of temperature or reduction at this time can produce damage that will be difficult or impossible to repair.

VACUUM MELTING

Some of the superalloys are now available in vacuum-melted form. Generally speaking, the vacuum-melted alloys have better properties than the air-melted versions. The reduction in impurities and the closer control of composition that is possible, provides more consistent properties and more uniform response to heat treatment.

In some cases the ductility of vacuum-melted superalloys is reported to be improved 3:1 over existing air-melted equivalents. Experience in machining is still limited, but first reports are that they are more difficult.

Forging

The work-hardenable and heat-treatable superalloys, even those with a fairly high cobalt content, can be forged. The cast alloys with a cobalt base are considered unforgeable.

There is less trouble with scaling than with more conventional metals. Heat-treatable alloys in the carbon group should be heated in neutral or slightly reducing atmospheres, the others should be heated in neutral or slightly oxidizing atmospheres. Avoid protective atmospheres that might cause carburization.

Soaking time at temperature should be short for A-286, but most of the superalloys require a thorough soak. Forging characteristics are similar to stainless, but more pressure is required and more frequent reheating is necessary.

Finish forging should be in the hot-cold work range for work-hardenable alloys, usually making any but roughly contoured forgings impractical. Titanium-hardened alloys with moderate nickel content are readily forged in dies to close tolerances. The other heat-treatable types can be precision forged also, but with more difficulty.

For consistent high-temperature properties, a schedule of heating temperatures, soaks, reductions, and reheats must be set up, tested, and adhered to closely. Departure from the established cycle will cause variations in properties, even after heat treatment.

Welding

Relatively high thermal expansion rates make it desirable to avoid rigid clamping devices that will set up severe localized stresses and lead to cracking. Hand methods have usually been more satisfactory than automatic methods.

All of the superalloys can be fusion welded. Inert-gas-shielded arc welding is the most satisfactory method in most cases. Where flux or coated electrodes are employed, all flux must be removed between passes.

If possible, heat-treatable alloys should be given complete heat treatment after welding; if not, weld in the solution-treated condition and age after welding.

Where filler metal is required, it should be an austenitic stainless rod. An effective weld, when clamping can be handled, is a butt weld with no filler metal made with an automatic inert-gas-shielded arc, and finished by roll leveling the bead to cold work the joint.

Resistance welds can be made by following austenitic stainless practice except that pressure is increased.

Machining

All of the superalloys are difficult to machine. They have a high shear strength and a tendency to work harden. In the annealed condition they tend to be gummy and in the hardened condition they may contain carbides in their structure.

In general, it is essential to use machines that are rigid and powerful. Best practice is to avoid machines that must be operated at capacity or slightly overloaded —such operations are more prone to chatter and overloaded machines may slow down or even stop as the tool dulls.

Any end-play, looseness of gibs, or lack of rigidity in the setup that could lead to chatter must be avoided. Tools should have heavy shanks, rigidly mounted, and toolbits should generally be as large as possible for any given operation.

Make cuts as close to the machine spindle as possible. When this can't be done, use steadyrests. For work mounted between centers, live centers are a necessity.

Work - hardenable superalloys can, and often must, be machined in the work-hardened condition. Where it is possible to stress relieve before machining, higher speeds are possible and better tool life will result. Although these alloys are not generally solution treated, this will improve the machinability and, if followed by aging, may result in better creep and stress resistance at high temperatures.

Tests of Timken 16-25-6, for example, have shown about three times the tool life when solution treated by heating to 2150 F, holding 2 hr. and water quenching, as compared with work-hardened material.

Heat-treatable superalloys, even those with an iron base, tend to be extremely gummy in the solution-treated form. Some aging will considerably improve the machinability, even though the material is harder. Partial aging, complete aging, or even overaging, may be chosen, depending on the circumstances. However, tests should be made of the effect on high-temperature properties. Complete reheat treatment may be necessary after machining to give the best properties.

Cast superalloys have often been considered unmachinable. This is not strictly true. Because they are usually precision cast, there has been little experience except with drilling and grinding.

TURNING

If high-speed steels are used, choose a cobalt grade such as T6, T8, or M30. If carbide tools are chosen, straight tungsten-carbide grades have given the best results because of the heat produced and abrasiveness of the materials. The new steel cutting grades, such as 370, are likely to be better for some operations, however. The heavy-duty grade, 370, will cause less trouble from chipping than the more wear-resistant grades, such as 350.

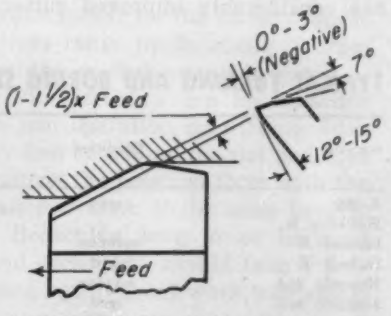
For most superalloys a sulfur-base cutting oil or a soluble oil with an extreme-pressure additive is necessary. When cutting oil is applied, use it generously, flooding the cut from above and below. A wax-water mixture has been effective in combatting built-up edge.

The harder the material is, the better will be the finish but the shorter the tool life. Some plants prefer the softest possible condition, but the hardened condition is preferred by the majority. Finish cuts should be made in the hardened condition.

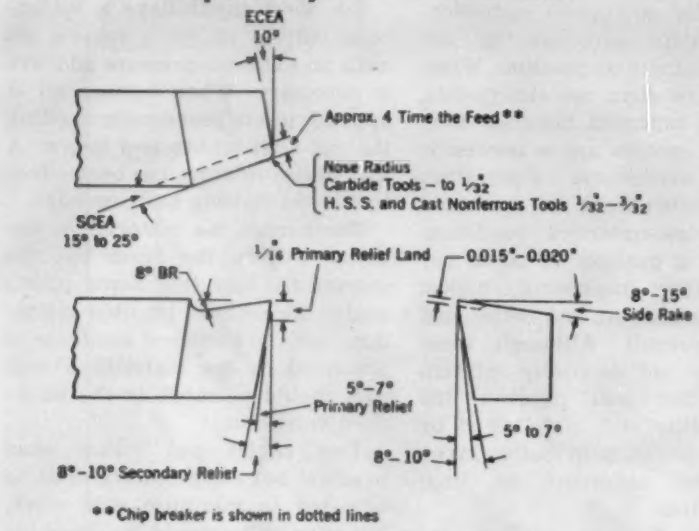
Tool angles can follow steel practice, but the geometry must be adjusted to minimize cold work. Negative rake would be desirable for support of carbide tools, but must usually be avoided to provide better shearing action. Back rake angles may range from 0° to about 8°, choosing the smallest angle that will be satisfactory for the material. A large side-cutting-edge angle is desirable, often 45°, and the point should be dubbed to produce a slight nose radius.

Grind carbide tools with care. Tools to be used with the highly alloyed metals should be ground with a 400-grit diamond wheel and visually inspected at 5 to 10X to see that the cutting edge is free of chips. Tools should be resharpened more frequently than usual, with a flank wear of 0.010 to 0.015 in. as the maximum when work hardening gives trouble.

Alloys especially vulnerable to strain hardening, such as Hastelloy B and X-40, require special care in handling. All roughing operations on thin sections should be completed before finish cuts are started.



CARBIDE TURNING TOOL of a type that works well on most superalloys for continuous cuts. Narrow negative land reduces cratering action



TURNING TOOL recommended for Inconel X and Nimonic alloys

MILLING

Climb cutting is much better than conventional, but requires heavy milling machines with no lost motion in the table. Rigidity is essential with substitution of larger arbors and close support advisable.

Cobalt-HSS cutters with positive true rake angles are preferred. Plain or slab milling is less efficient than face milling, but when used the cutters should be mounted on the arbor so that cutting forces are directed toward the spindle. For end milling, use four-lip mills with 30 to 45° helix.

If the alloy is gummy and chips stick to the teeth, it is desirable to mount a wire brush or other form of chip knocker to remove the chips before teeth re-enter the cut.

In milling of A-286, with HSS cutters, addition of a radius where the normal 45° chamfer is applied has considerably improved cutter life. In side milling tests a cutter with 10° peripheral clearance has given much better results than one with only 5° peripheral clearance. Similar experience is reported with Nimonic 80A, with the highest cutting speed being possible when clearance was increased to 18°.

Soluble oils have been satisfactory in milling A-286 with HSS. Speed is 40 to 50 sfpm with 0.010-in. chip load. This cutter had a 10° radial rake and a 1/32-in. radius at the chamfer.

Some carbide milling is being done with 370 carbide. End mills can operate at 300 sfpm on A-286, a depth of cut of 0.005 in., and a chip load of 0.002 to 0.003 in. A sulfurated cutting oil is necessary.

Tests of a new type of cutter with an unusually high helix, 72°, have indicated good results on Inconel X and Nimonic 80A at speeds of 210 sfpm. The cutter has 0° radial rake. Although the flutes are very small, the high helix appears to enable the cutter to clear itself of chips.

High-rake milling cutters (AM —Apr 3 '50, p122; Sep 28 '53, p133) should be considered in milling superalloys. They have rake angles much higher than the normal 4 to 10°, typical radial rake being about 30°. Clearance angles are not changed. The effectiveness of these cutters in milling difficult materials has been demonstrated and they cut with the shearing action needed for superalloys.

DRILLING

Most drilling is with HSS drills. Better results are possible when a cobalt grade is chosen. Drills should be as short as possible and of heavy-duty design. A blunt point angle of 135° and a clearance reduced to 8° are suggested. Cutting edges should have a flat for strength.

When possible, use a drill bushing. Pull the HSS drill from the hole frequently to free it of chips and to prevent overheating. Constant feed is essential whenever the drill is in contact with the work.

Heat-treatable alloys are best drilled in the solution-treated condition. Use a cutting oil with lubricating qualities.

Gun drills of HSS or carbide are suitable for holes under 1-in. dia. Feed rates should be 0.0005 to 0.002 ipr. Spade drills are often the most satisfactory for larger holes. They can be either cobalt-HSS or straight tungsten carbide. Typical feeds are 0.001 to 0.003 ipr.

Cast alloys require carbide drills with mechanical feeds. Vitallium can be drilled at 12 to 18 sfpm with a mechanical feed of 0.001 to 0.003 ipr. In this particular case, coolant does not appear to help.

X-40 has been drilled with carbide at speeds as high as 35 sfpm, but feed should not exceed 0.001 ipr. Work must not be permitted to shift with carbide drills or the drill will break. A good drill is one with a point similar to a crankshaft drill with 118° point angle, a 5° primary clearance, and a 15 to 20° secondary clearance. This secondary clearance is important as it allows chips to be

TYPICAL TURNING AND BORING SPEEDS AND FEEDS FOR SUPERALLOYS

Material	Condition	Feed, ipr	Speed, sfpm HSS cast alloy	Speed, sfpm Carbide
A-286	aged		40	150-350
Hastelloy B		0.006 to 0.12		75-150
Inconel X	solution	0.008 to 0.015	25-35	45-60
Inconel X	aged	0.008 to 0.015	10-25	25-50
Nimonic 80A	solution	0.008 to 0.015	25-35	45-60
Nimonic 80A	aged	0.008 to 0.015	10-20	30-50
Refractaloy 26	aged	0.003 to 0.008	40-65	
S-816	aged	0.009 to 0.011		50
Timken 16-25-6	work hardened	0.011 to 0.014		125-300
Waspaloy	aged	0.014 to 0.018	12-16	

expelled without rolling around, reducing work hardening and chatter.

Best practice with carbide drills for most of the alloys is to use a cutting oil and feed through without withdrawing.

TAPPING

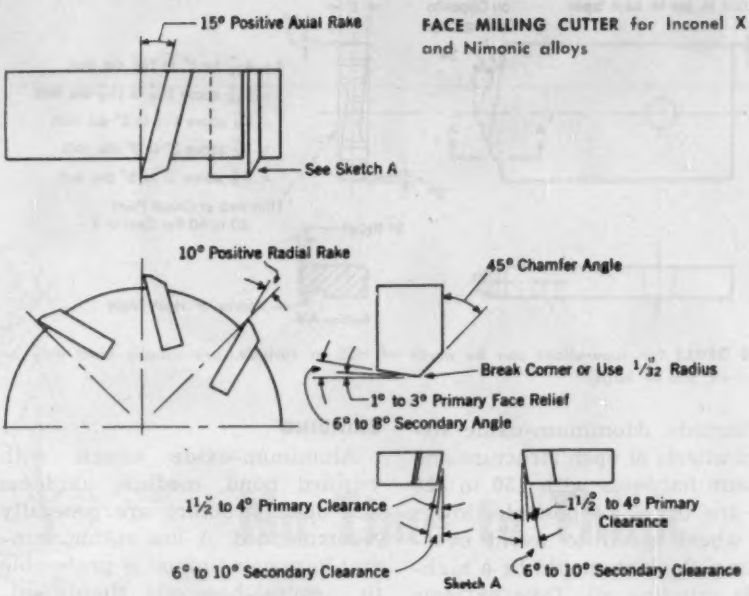
Decrease the percent of thread to 60% if possible by selecting larger tap drills than normal. (Actually a 45% thread will hold in most applications.) Often a tap drill for a 50% thread will result in a 65% thread after tapping because the metal tends to spin up in tapping.

Taps should have as few flutes as possible to provide plenty of chip room. Face rake angles of 5 to 8° are normal, but better results have been reported with taps that have high face rake, about 25°, similar to high-rake milling cutters. Increase the clearance to avoid drag on the heel. On particularly difficult tapping operations it may be better to tap in two or three stages. Avoid blind holes.

A chamfer on the front of the tap is necessary to lead it into the hole. Chamfers must be evenly ground to assure proper cutting, so should not be ground offhand. Starting taps should be chamfered for 8 to 10 threads, intermediate taps for 4 or 5 threads, and finishing taps for 1 or 2 threads.

When taps drag despite adequate relief, reduce the width of the lands about 20% for free cutting. Both back taper, about 0.001 in. per inch of length, and thread relief contribute to satisfactory tapping.

Cutting oil or wax lubricant is suitable. Wax pellets placed in the holes have been found especially good. The operation of inserting the pellets can sometimes be avoided by applying the wax to the tap. After tapping, wax can be left on the tapped threads or removed by degreasing.


15° Positive Axial Rake
See Sketch A
10° Positive Radial Rake
45° Chamfer Angle
Break Corner or Use 1/32" Radius
1° to 3° Primary Face Relief
6° to 8° Secondary Angle
1½° to 4° Primary Clearance
6° to 10° Secondary Clearance
1½° to 4° Primary Clearance
6° to 10° Secondary Clearance
Sketch A

FACE MILLING CUTTER for Inconel X and Nimonic alloys

REAMING

Carbide reamers are usually necessary for the superalloys. A definite cut must be taken to avoid riding of the reamer.

Work-hardenable alloys can be reamed by following the general practice for austenitic stainless steels.

Heat-treatable alloys are normally reamed in the age-hardened condition, except that Inconel X can be handled better in the stress-equalized or high-temperature aged form. Gumminess in the solution-treated form is likely to cause tearing, so reaming in this condition should be avoided.

High-nickel alloys should be reamed at 20 to 25 sfpm with feeds of 0.006 to 0.010 ipr. Depth of cut ranges from 0.010 in. for holes under 1-in. dia up to a maximum of about 0.062 in. on 7-in. holes or larger. Reamers should have a land 0.005 to 0.015 in. wide with 0° clearance. Slightly higher speeds are suitable for the heat-treatable alloys with lower nickel content.

For the cast cobalt alloys, speeds of about 35 sfpm are suggested with a feed of 0.003 to 0.005 ipr. Replacing the chamfer at the end of the reamer with a radius will reduce the tendency to chatter. There should be a land of 0.005 in. wide with 0° clearance.

BROACHING

Heat-treatable alloys broach better and require less power in the age-hardened condition. Broaches of HSS, hardened and double tempered to 64 R_c, will produce satisfactory results at low speeds. Suggested speed for Inconel X and Nimonic is 6 fpm. From this minimum, speeds for the various superalloys range up to about 32 sfpm for the work-hardenable group.

Pinetree slots can be broached in one operation on turbine disks by first broaching the slot and then cutting the pinetree form with the last few teeth of the same broach.

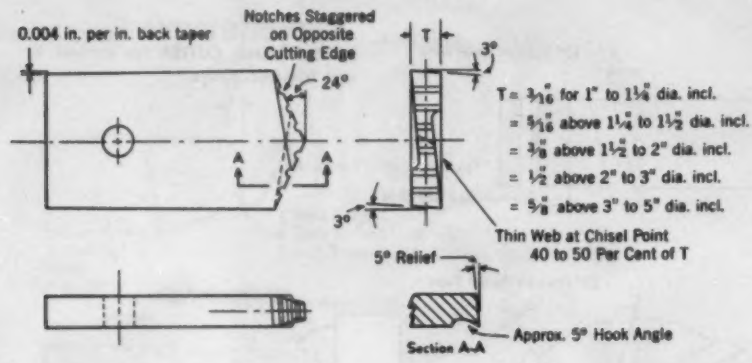
Broaching setup must be rigid and each tooth should take a definite cut to avoid work hardening.

THREADING

Thread grinding is the most common method of cutting exter-

TYPICAL DRILLING SPEEDS AND FEEDS FOR SUPERALLOYS

Alloy	Condition	Speed, fpm		Feed, ipr	
		HSS	Carbide	1/16-¼	¼-¾
Inconel X	solution treated	10-20	20-40	0.0005-0.002	0.002-0.004
Inconel X	aged	7-20	20	0.0005-0.002	0.002-0.004
M-252			12-18	0.001-0.003	
Nimonic 80A	solution treated	10-20	20-40	0.0005-0.002	0.002-0.004
Nimonic 80A	aged	7-12	20	0.0005-0.002	0.002-0.004
Refractaloy 26	aged	25		0.002-0.004	0.004-0.006
Refractaloy 70	aged	15-30			0.003-0.007
Timken 16-25-6	solution treated	50		0.002-0.004	0.004-0.006
Haynes No. 31 (X-40)	as cast		12-18	0.001 max	


0.004 in. per in. back taper
Notches Staggered on Opposite Cutting Edge
24°
A
A
T
3°
T = 3/16" for 1" to 1 1/4" dia. incl.
= 5/16" above 1 1/4" to 1 1/2" dia. incl.
= 3/8" above 1 1/2" to 2" dia. incl.
= 1/2" above 2" to 3" dia. incl.
= 5/8" above 3" to 5" dia. incl.
3°
Thin Web at Chisel Point 40 to 50 Per Cent of T
5° Relief
Approx. 5° Hook Angle
Section A-A

SPADE DRILLS for superalloys can be made of HSS or carbide, are usually used only on holes 1-in. dia or larger

nal threads. Aluminum-oxide vitrified wheels of open structure and medium hardness with 150 to 320 grit are usual. If possible, lower the wheel speed to avoid overheating. Coolant should be a high-grade grinding oil. Take extreme care to avoid overheating. Thread grinding has not worked with A-286.

When threads are cut with self-opening dies, a roughing and finishing cut are usually desirable. Cutting speed for Inconel X is 10 fpm or less.

Single-point tools give good results, especially in automatic machines. Typical speed for Inconel X is 10 to 15 fpm. For thread milling, revolve the blank at about 2 ipm and cutter at 15 to 30 fpm.

CUTOFF

Hacksaw blades should have 4 to 6 tpi if the work is large enough to permit such a coarse blade. Machines should be slowed down to 30 to 40 spm with a feed of 0.003 to 0.006 ips. Heat-treatable alloys can be cut best in solution-treated form.

Circular saws are satisfactory for most of the alloys at 15 to 20 sfpm and a feed of 0.0005 to 0.0009 ipt. Teeth should have radial rake of 5 to 8° and enough side clearance to prevent dragging on the work.

Abrasive cutoff with aluminum-oxide, rubber-bonded wheels is the only satisfactory method for the cobalt-base alloys, and the most satisfactory method for many of the others when in the hardened condition. Wet cutting is recommended with a lean solution of soluble oil or a rust inhibitor.

GRINDING

Aluminum-oxide wheels with vitrified bond, medium hardness and open structure are generally recommended. A low sulfur, mineral base grinding oil is preferable to chemical-base oils. Highly sulfurized oils give the best results but can't always be used because of pitting problems. Apply the grinding oil generously, through the wheel when possible.

Better grinding ratios are obtained with most of the cobalt alloys than with the nickel alloys. Wheel speed, table feed, and the ratio between them, are all critical.

Overheating the surface must be avoided for all of the usual reasons involving burning, heat checking, and cracking, plus the danger of damage to the high-temperature properties of the alloy. Avoid dwell of the wheel as much as possible.

Increasing table feeds will wreck the grinding ratio and thus the efficiency of the cut. Too slow a table feed will cause burning. For a given material, therefore, the best table feed will usually be one that is just high enough to avoid any risk of overheating the work.

Decreasing the wheel speed will reduce the chance of burning the work and there are preliminary indications that this can be done to some extent without serious loss of grinding ratio.

It must be accepted that with the characteristics of the superalloys and the wheel types required for satisfactory grinding, grinding ratios will be relatively low. They may range from as low as 2 or 3 for some of the alloys extremely high in nickel to as much as 35 or more for those with a high iron content.

For A-286, a wheel of I hardness has been reported to give good results in surface grinding. A softer grade is required for internal grinding, and a harder grade for external. Best range for wheel speed has been 5500 to 6500 sfpm. A similar wheel works relatively well with M-252, but wheel speed is reduced to 4500 to 5000 sfpm. Work speed is 28 to 30 sfpm. With a low-sulfur, mineral-base grinding oil applied through a 60-grit wheel of No. 6 structure, a finish of 20 to 30 mu in., rms, can be obtained. Finer-grit wheels tend to load rapidly.

The cast cobalt-base alloy, X-40, is production ground with wheels of J hardness and No. 6 structure in an 80-grit wheel. Wheel speed should be 4000 sfpm or less with a work speed of 35 to 50 sfpm. Incidentally, one test reported surface hardness increased from 20-24 R_c to 40-42 R_c by grinding.

In form grinding many of the superalloys, better results are obtained with a small wheel than a large one, because of the improved contact arc.

ABRASIVE-BELT GRINDING

Aluminum - oxide - coated cloth belts are a desirable method of grinding, particularly on contour work. A typical procedure is to rough grind with 80 grit, followed by semi-finishing with 120 to 150 grit, and final polishing with 180 to 220 grit. Rough grinding may be done dry or with a light oil. For semi-finish and finish operations, a suitable lubricant is cottonseed oil thinned with turpentine to provide high flowing characteristics.

We appreciate ...

the valuable assistance in the preparation of this report provided by the following companies:

Allegheny Ludlum Steel Corp
Curtiss-Wright Corp
General Electric Co
General Motors Corp
International Nickel Co
Marquardt Aircraft Co
Norton Co
Pratt & Whitney Aircraft
Westinghouse Electric Corp

Round Table

No Time to Think

"I got good and mad at that smart industrial engineer we listened to last night at the foremen's meeting, Al. How the hell are we supposed to be able to take time to reorganize our time when we don't have enough time to start with?"

"He had a lot of good ideas to offer, Ed. The trouble with you is you don't recognize them and won't apply them."

"Oh, I can apply them, Al. I just sit down and forget all about such things as production, supervision, employee relations, and paper work; and think. I can see me getting away with it. How long do you think that bunch of bums in the toolroom would keep working if I did?"

"Maybe a good bit longer than you think, Ed. I doubt if you're indispensable to production; I know I'm not, which is why I'm not afraid to take time off for something important when it comes up."

"What's more important than production? Oh, I suppose you could leave that machine shop—they're on piecework and feel responsible for their work; but can you see me leaving the toolroom flat and expecting things to keep going?"

"Why not, Ed? I should think toolmakers would be just as responsible as machinists—more so. Sure, there's always somebody waiting for me to come back so I can hold his hand for him; but most of the little problems are solved by the men themselves—providing they don't always have somebody handy to lean on."

"Look, Al; I get paid for keeping the men working, and I expect to be there all the time. I haven't got time for reading magazines and reports, or going to special demonstrations. I'll leave that to you young squirts who aren't as serious about your work."

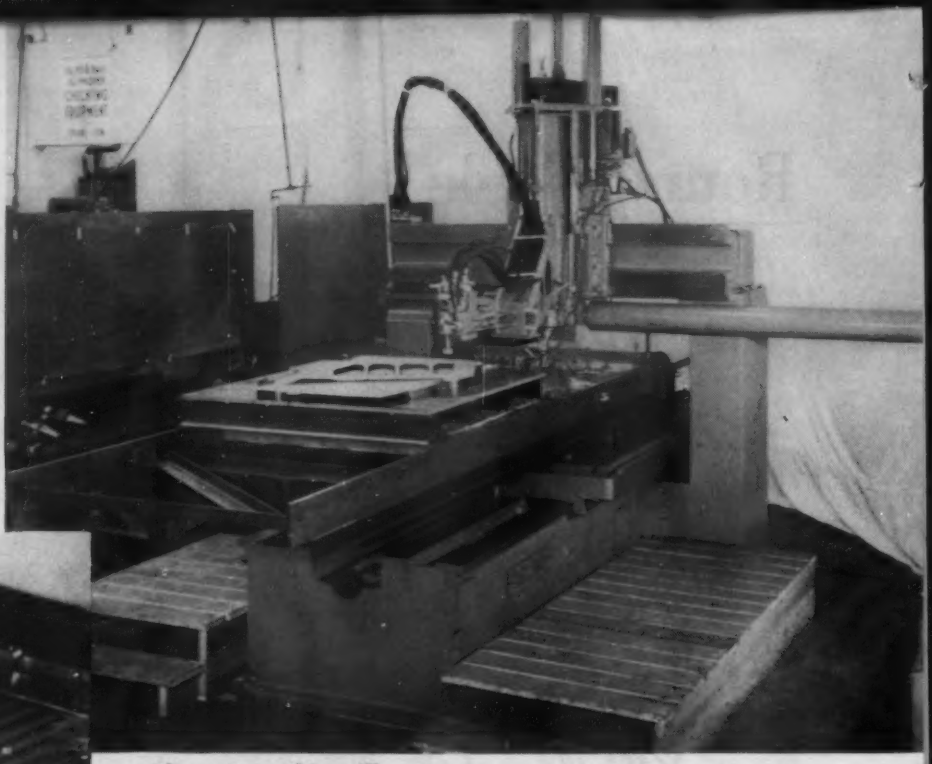
"I'm perfectly serious about this part of my work, Ed. I just don't believe in making myself a crutch for every lazy man in the department who doesn't want to do his own thinking."

"In other words, you think I'm a lousy foreman because I help the men, instead of leaving them flat; is that it?"

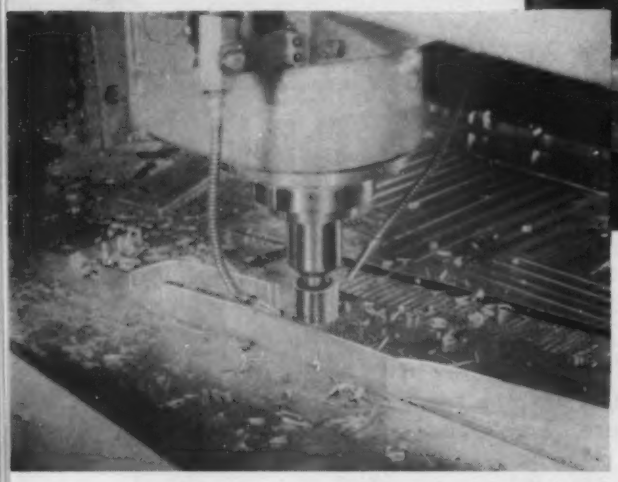
"Not at all, Ed. I don't leave them flat; but I do think you worry too much about minor details when you could be using your time better."

"Details are what make production, Al, and that's what I'm paid to keep track of. If I didn't, I wouldn't be earning my pay."

Is Al right in refusing to answer all the questions his men might come up with; or is Ed right in always being available to help his working force? Your ideas on the subject may help others with supervision problems. *Discussions of earlier topics start on page 200.*



Profiling perimeter of skin shows machine is capable of taking a healthy cut with a 2-in.-dia HSS end mill 2 in. deep, at 31 ipm without abnormal chatter



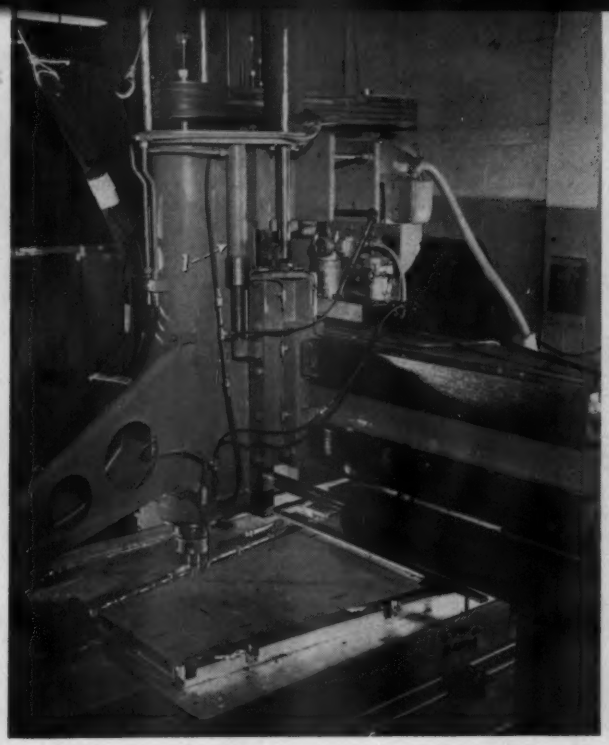
Planer-type-skin mill was designed in three months to meet requirements for machining skins of medium-size class. Existing machines on the market were either too small or too large for this class of skin. Machine was built by using the bed, the two uprights and crossrail from a Fitchburg machine built in 1940. Remainder of machine and controls were built and assembled by Island's maintenance crew in another three months. Extension worktable bolted to original Fitchburg is 60x168 in. and has a travel of 108 in. Spindle runs at 3600 rpm from a 15-hp motor, and a 5-hp motor provides power to hydraulic system for driving table from 0 to 40 ipm. Two hydraulic cylinders on top of spindle assembly are actuated by metering valve on tracer head for adjusting spindle travel from 0 to 40 ipm

Machine conversions help "Sew Up"

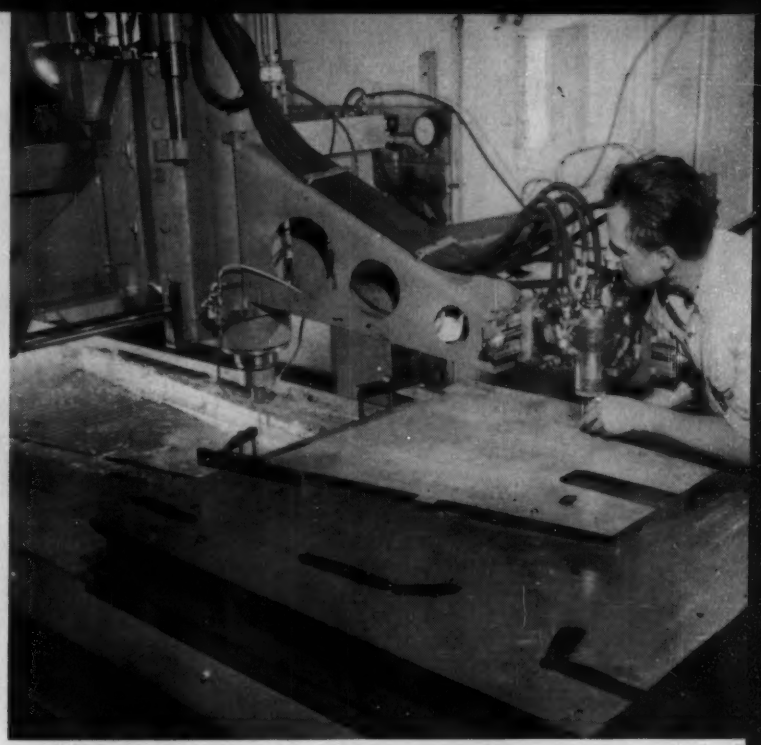
JOHN P WRIGHT, associate editor, in cooperation with LEONARD H DUBUKE, project engineer

In a small jobbing shop with a limited working budget, juicy contracts need not be passed up because of lack of finances for special machine tools. At Island Machine Co, Inc, Farmingdale, LI, the engineers have a unique program whereby they apply their combined ingenuity to build special machines for specific jobs from several stripped down second-hand pieces of equipment.

Plant surveys enable them to draw up preliminary designs of special machines to fit these jobs and also to keep a weather eye peeled for types of second-hand machine tools that can be converted to fit the designs. Aside from the standpoint of economics, these conversions are built to fit the gap which many times exists between small and extra large machines available on the market and found unsuitable for Island's special class of jobs. Our pictures show how some of these special machines were designed and built to do specific tasks.

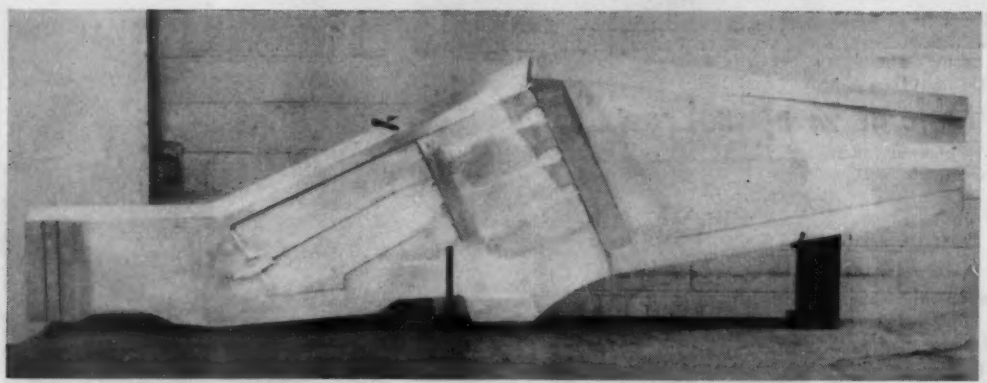


Balancing cylinders compensate for overhanging weight of spindle and tracer boom by maintaining uniform load on crossrail saddle. Hydraulic cylinder below crossrail is for crossfeed of spindle controlled by tracer head. Mist lubrication is supplied to spindle assembly and vertical slide, crossrail, and tableways. Locating pin shown in spindle adapter is being used to position tracer head to templet



Profile-milling perimeter of skin with a 3D "True-Trace" hydraulic head. On end of boom note horizontal dovetail slide for aligning tracer head to reference points on work during setup. Operator exerts 3 to 5 oz side pressure on stylus when tracing around templet. To machine a complete skin, four templets are used to correspond to three tooling positions 40 in. apart provided on rails along length of machine table. When a given area of skin has been machined, templet table is moved over that area and positioned in locating holes established in table rails. Second templet is set up and tracer stylus is adjusted as reference holes in templet and work are "indicated in" for alignment

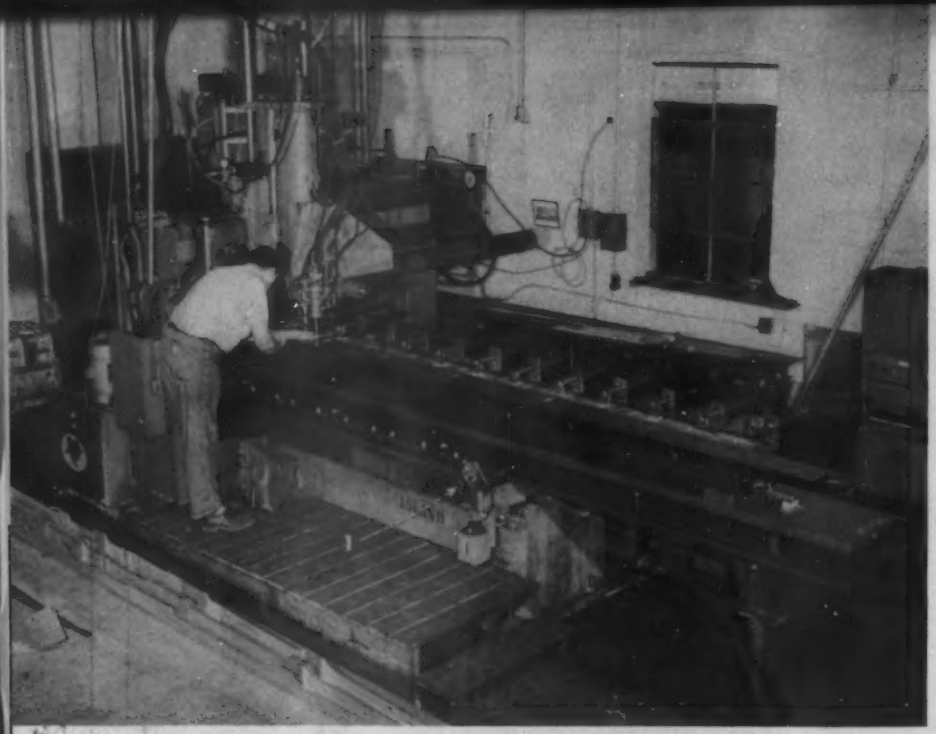
lucrative contracts



Rear view of machine with skin three-quarter machined. Operator is preparing to position skin to templet work table for last-stage machining. Workpiece is held to table by a vacuum chuck. On large, critical workpieces, as a precaution, outer edges are screwed down. Machining final area, shown by layout lines, on this particular skin, required moving entire vacuum chuck and skin forward to a position within range of table stroke. Tapered cuts are accomplished by placing masters beneath cutouts in templet. Templets are laid out and hand finished. When required, tracer head can hold tolerances to ±0.0005 in., providing templets are accurately made. On long-run jobs, three-dimensional castings are used in place of templets

Aircraft skin machined complete in one setting on the planer-type miller. Aluminum skin 75ST6 is 11x4 ft, had a gross weight of 1007 lb and after machining weighed 450 lb. Machined areas vary in thickness from 1⅜ to ¼ in. and tolerances for step milling and tapers were held to ±0.0015 in., while all other dimensions were held to ±0.005 in. Surface finish ran to 63 mu in. rms, using HSS cutters exclusively. When completed skin was removed from machine, it was relatively flat from end to end and was free from waviness as well as skewing

Conversion story continued ▶

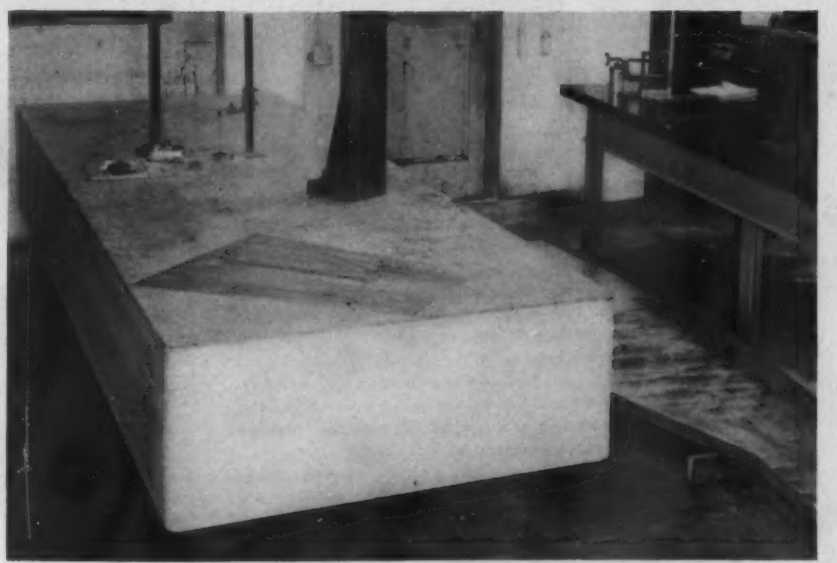


Auxiliary table powered by original hydraulic system has its own control valve for independent table feed. It was added to the machine to enable machining intricate spar 156 in. long in one setup. Additional table is a weldment built up from an I-beam and hot-rolled plates and now provides machine with a total travel of 180 in. Feed-control valve 7 regulates speed of upper table for a travel of 72 in., while tracing head controls feed of lower table. Spar shown in setup is 14ST6 aluminum, 3½x5½ in., having a gross weight of 304 lb and a net weight of 18.5 lb. Dimensional tolerances are held to plus 0.005 minus 0.000 in., and machining time is 25% faster because of the single setup with auxiliary table

Checking finished wing spar after 93.94% of original stock was machined away in chips. Edge thickness of spar flanges were 0.050 in. thick and angular tolerances were held to ±15 min. Surface finish ran to 63 mu. in. rms on 2/3 of machined surfaces with 125 mu. in. rms on balance. 85% of all machining was done with the tracing head

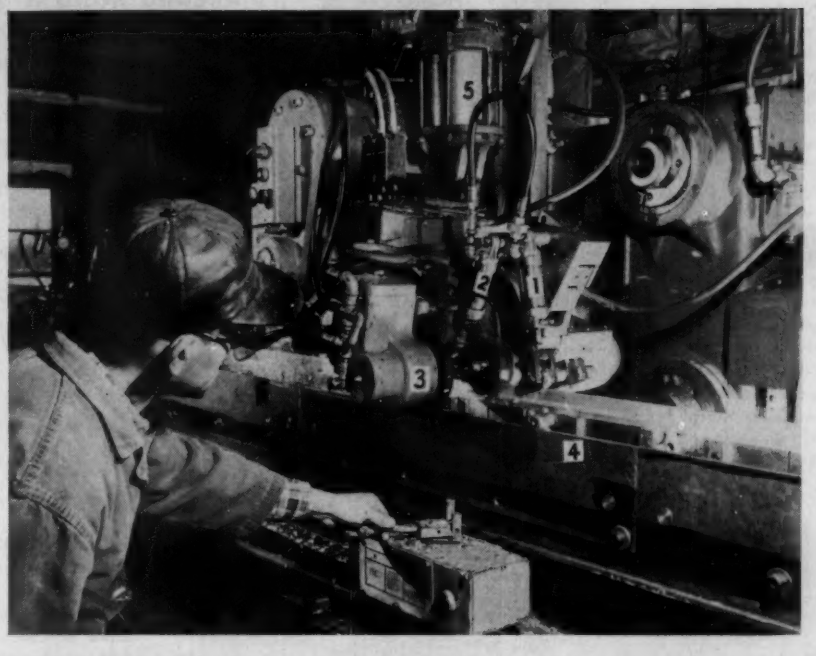
Granite layout table at ¼ normal cost . . .

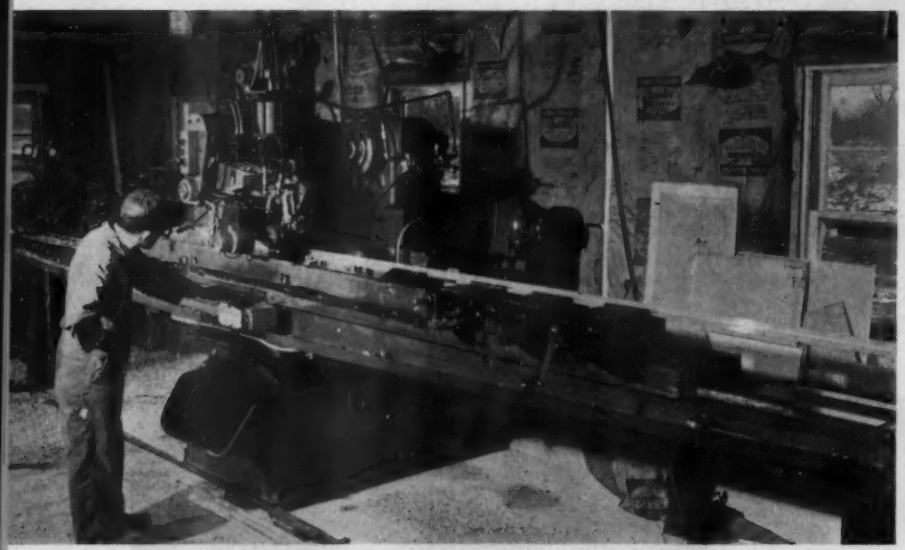
Money shortage coupled with an absolute need for a large granite layout table required some real deep thinking on the part of Island's president. Playing a hunch, he drove to a small quarry where he had them cut a choice slab of granite. Then after explaining how to lap the top surface, he ended up with a layout table 4x12x1½ ft, and accurate across the diagonals to within 0.001 in. Total cost was ¼ normal, which just about fit the pocketbook in those days



Spar-and-stringer miller from a two-spindle Sundstrand . . .

Shop designed and made this aircraft spar-and-stringer milling machine from a two-spindle Sundstrand miller. Here again existed the need for a special machine for handling work of medium length. It is partially automatic in operation with electrical switches activating air cylinder *1* for work holddowns and another air cylinder *2* which partially rotates cutters about a pivot point for rise and fall of cutter engagement. Another set of electrical switches start and stop cutters at relative positions. Follower *3* is an integral part of pivot arm and guides cutters over profile established on templet *4*. Operator is manipulating lever for feed—feed stop —and rapid reverse. Accumulator *5* maintains constant uniform pressure of 40 psi on two air cylinders while machine is running

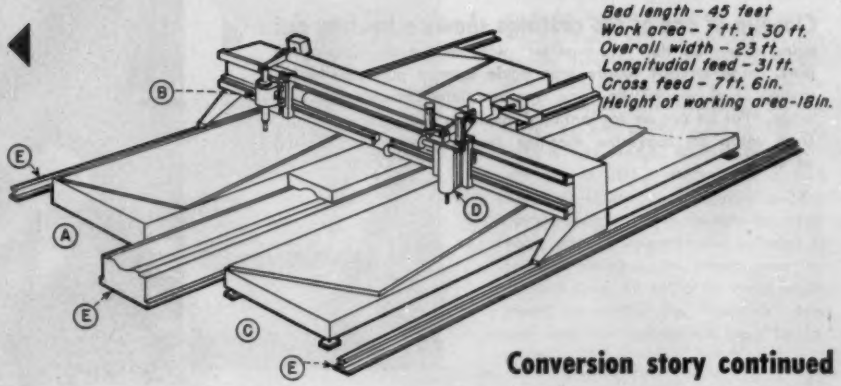




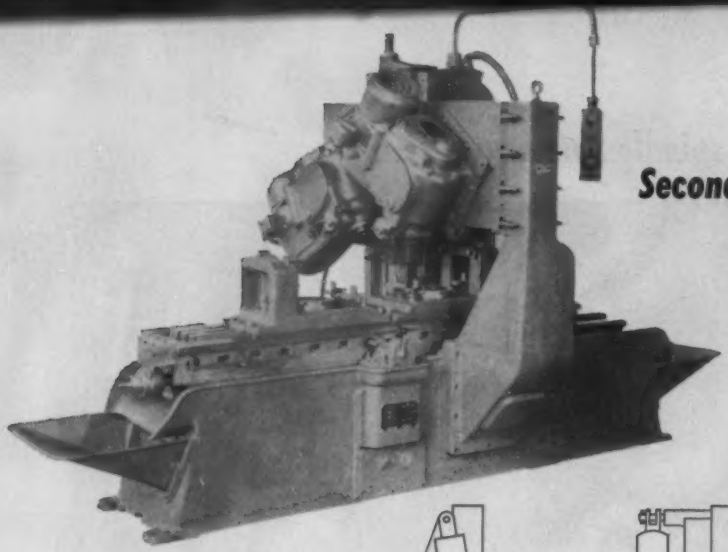
Structural-iron frame, plus cast-iron table with steel ways, make up auxiliary 20-ft work table. Gear-box feed to table is driven from lower spindle on original Sundstrand machine. Work 12 ft in length can be machined complete in one pass and 25-ft lengths can be handled by indexing part end for end. Aircraft spar 12 ft long, of 75ST aluminum, is being contour-machined by two 5-in.-dia carbide cutters at 3600 rpm, feed of 175 ipm, and depth of cut ⅜ x 2 in. wide. Table feed is adjustable from 12 to 345 ipm with rapid traverse in proportion to feed. Spar was originally machined at 51 ipm, and when gradually increased to 175 ipm, tool life improved 75%, a much finer surface finish was obtained, and all warping to the spar was eliminated as the heat was dissipated into the chip

Proposed beam mill . . .

Beam mill for contour milling is a proposed project for the near future. At *A* is the templet and tracer head *B*, while *C* is aircraft skin with cutter spindle head at *D*. Work and templet remain in fixed position while crossrail travels over machine ways *E*. Both tables are supported on pivot points which will permit machining of large tapered skins as well as sculpturing. Onsrud spindle head will rev up to 3600 rpm, and will be guided by a 3D tracer head. Adjustable table feeds will range up to 120 ipm

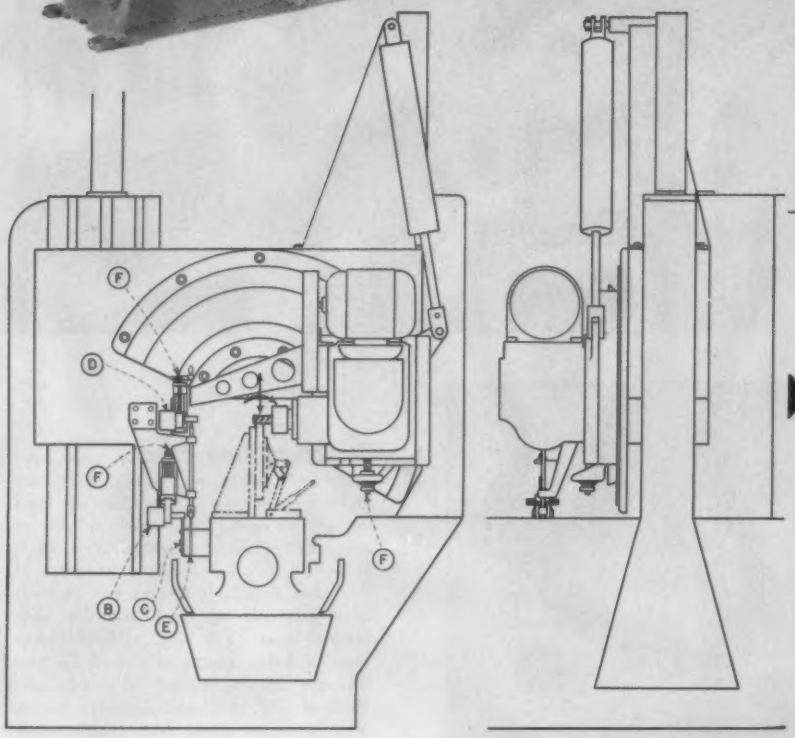


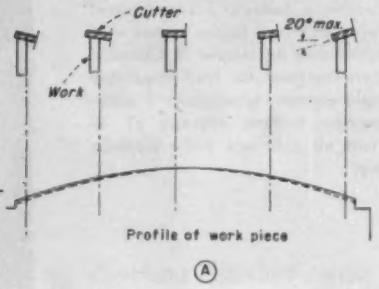
Conversion story continued



Second hand Rigidmil converted to twistmill . . .

Sundstrand Rigidmil was purchased on second-hand market for conversion to the special twistmill. Need for this conversion arose from the availability of many sub-contracted production jobs of a medium-class size, which were begging for takers. However, nature of these jobs required a machine with special tooling, if they were to be machined economically. Securing these jobs presented no problem after the shop men reconverted the Rigidmil to the twistmill as shown in the drawing below

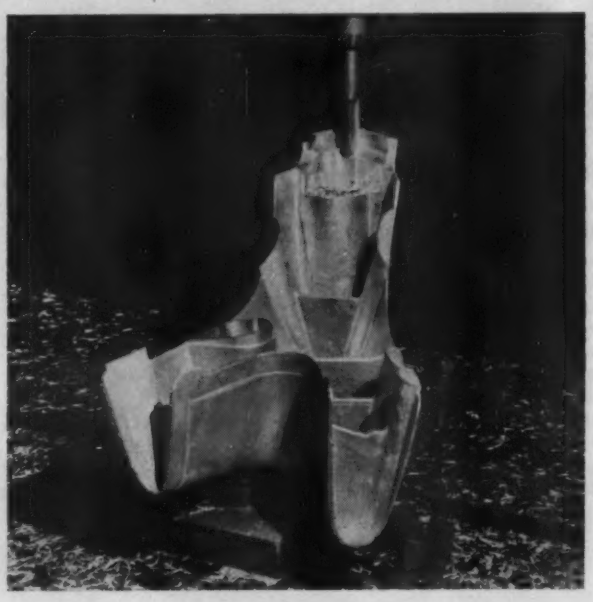




Reconversion will have two 180° tracing heads which will also provide for 3D milling. Working area is 17x60 in. with a table travel of 48 in. Tracing head *B* riding on templet *C* controls rise and fall of spindle head; while tracer *D* and templet *E* provide twist or rotation to spindle riding in saddle *I*. Micrometer adjustment screws *F* provide for bringing cutter and styli into alignment. Illustration at *A* is a typical job scheduled for this machine. Cutter tilt is held to 20° because this is point of maximum deflection of stylus. However, indexing of tracer head at this point will permit profiling at increment position to 90°

'Makin's' from two machines build 'Tru-Ingertel' . . .

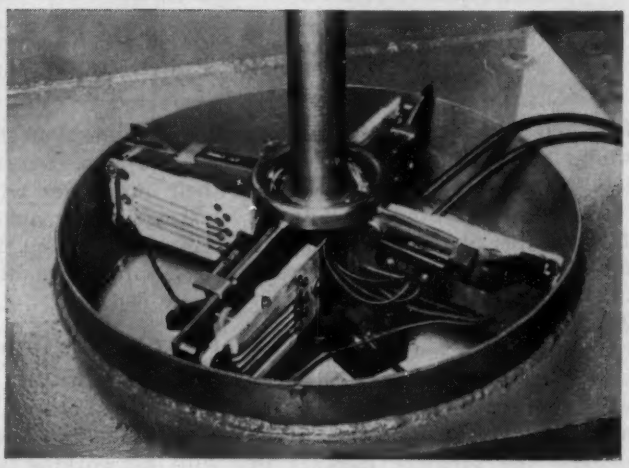
Closeup of one of the castings shows a healthy cut being taken on the "Tru-Ingertel" with minimum clamping of part. Large aircraft fixture was made from a permanent-mold casting of aluminum alloy and was completely machined in one setup. Pilot lot run on conventional machines required six setups. Dual setup on converted machine resulted in a time saving of 400%

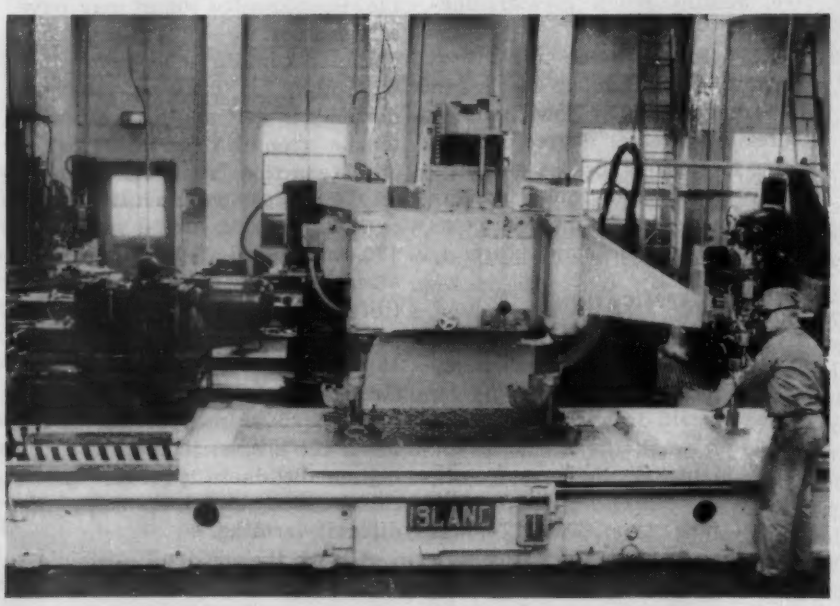


Gyro-positioner . . .

Gyro-positioner for welding was built to decrease production time on a long-run job which presented a difficult handling problem. When job was done by conventional welding methods, it consumed considerable time. In addition, because of complexity of the part, heat became confined in the acute-angle corners of the workpiece, causing overheating of the torch tip which in turn resulted in a backfire and cold spots on the part. Now, using the gyro-positioner, the welder can index his work to any position by simply manipulating a gimbal disc with his feet. Rocking gimbal will rotate work 360° in any plane without hand adjustment. Job is a wing hinge of chrome-moly 4130, which is first tack-welded, then clamped in a holding fixture on positioner for continuous welding of seams having a linear length of 12 in. Welder completes one wing hinge in 12 min., while best time on previous hand method was one per hour

Gyro assembly on welding positioner was mastered by the welder after 5 hr of practice. It also minimized fatigue and aggravation normally experienced by welders working by conventional hand methods and holding fixtures. From the standpoint of safety, because the welder never has to touch or handle the part, it is clamped so burns to the hands are eliminated. Control mechanism is comprised of four levers each of which actuates a rheostat and a Micro-Switch. Gimbal disc (removed) is universally mounted to vertical shaft and rests on each of four operating levers in a normal, or off position. With the workholding carriage shaft in a horizontal plane facing operator (neutral position), depressing right hand side of disc will cause work to rotate clockwise. Depressing left hand side of disc will cause counter-clockwise rotation. When front or rear edge of control disc is depressed, the motorized carriage travels down or up the "C" yoke rail. Control levers that actuate rheostats cause the motors in the circuit to run at a speed relative to amount the lever is depressed. Reversing Micro-Switches control the direction of motor rotation depending upon which side disc is depressed





Machining aluminum aircraft castings on another machine, built from the "makin's" of a Cincinnati two spindle Hydro-Tel and an Ingersoll milling-machine bed. It was primarily designed for large fittings, skins, and intricate work. New hydraulic system gives greater rise and fall for spindle head and longer travel to table. It has three spindles of Island's own design and the boom equipped with a 3D tracing head, can be indexed to any spindle position. Outer hydraulic cylinders on table provide feed, while center cylinder is a compensator. Table driven by 5-hp motor has a 12-ft stroke with a max feed of 60 ipm. Each spindle has a 20-hp motor and a max speed of 4500 rpm. By adding a 2-ton counterweight to compensate for overhang and a longer-stroke cylinder to spindle housing, its travel was increased from 28 to 36 in. Steel weldments assembled the "makin's" into one machine nicknamed the "Tru-Ingertel"

Freezing plus working makes stainless super-strong

At sub-zero temperatures you can carry out severe forming and bending operations that would cause cracking at room temperature. And you can boost the physical properties to make strong, lightweight products

V N KRIVOBOK, Sc D, in charge, C R MAYNE, staff member
Stainless Steel and Heat-Resistant Alloy Section, INTERNATIONAL NICKEL CO

Research discloses that several things happen to austenitic stainless steels at low temperatures:

1. Like any other metal, an 18-8 such as type 302, increases in tensile strength when chilled—in fact the annealed metal is nearly 2½ times as strong at –320 F as at room temperature. Compared with other metals, stainless steels—which are considered high-strength materials at ordinary temperatures—show the greatest increase in strength at low temperatures, whereas most other metals embrittle rapidly.

2. As temperature drops, stainless steels in general lose toughness far less than other metals. *The surprising fact is that hardened or cold-worked stainless steels actually show an increase in ductility.* Elongation of type 302 in the ½-hard condition more than doubles at –150 F, as compared to room temperature.

3. The reason for these gains in properties is the big increase in rate at which 18-8 stainless steels work harden at sub-zero temperatures. Type 302, for an example, has a tensile strength of approximately 160,000 psi when cold worked at room temperature to a 40% reduction. But when reduced the same amount at –320 F, type 302 is a 250,000-psi material.

4. Stainless steels cold worked at sub-zero temperatures keep their properties when they have warmed to room or operating temperatures, and they do not lose these properties at temperatures up to 800 F.

PRACTICAL ADVANTAGES

By working 18-8 steels at sub-zero temperatures, they can be strengthened to the same degree with *less* working than they would require at room temperatures. Consequently, the sub-zero formed steel retains much greater ductility.

Or, with the same amount of working, 18-8 stainless steels can be strengthened at low temperatures to a greater degree and yet suffer no serious loss in ductility.

And finally, cold-rolled tempers can often be formed more successfully at sub-zero temperatures.

POTENTIAL APPLICATIONS

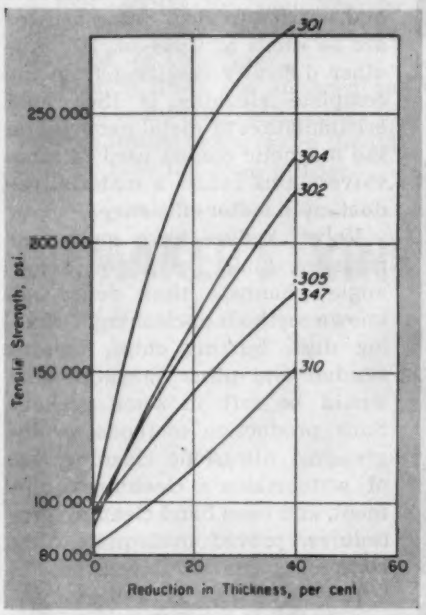
There are two ways to impart strength to austenitic (non heat-treatable) stainless steels: (1) by rolling or cold drawing at the mill, or (2) to work the metal at the user's plant, as by press tools, cold-roll forming, etc.

Until now, type 301 (17-7) is the grade of stainless that has been most used for highly stressed, work-hardened structures. Examples: aircraft parts, railway cars, etc., where designers have been able to achieve a favorable strength-to-weight ratio with a design stress of 150,000 psi.

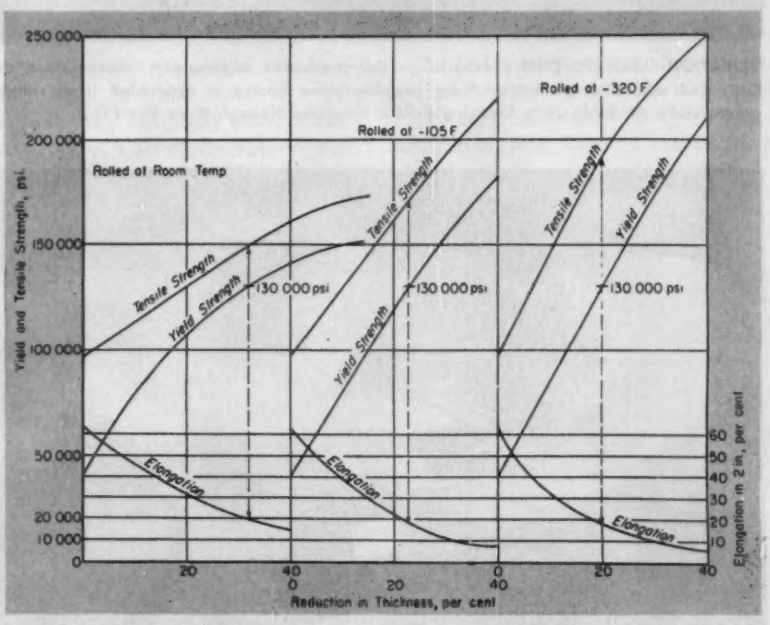
On the other hand, the bulk of stainless steel is purchased in the annealed condition. The very useful 18-8 (type 302) is normally thought of as an 80,000- to 90,000-psi material. At room temperature this stainless is more difficult to work than carbon steel, and it work hardens rapidly. For example, the annealed metal may have a high ductility—up to 60% elongation in 2 in. But a 20% reduction by rolling or drawing cuts the ductility in half and may raise the tensile strength only 35,000 psi. A 55% reduction boosts the strength to 170,000 psi but ductility drops to 7%. However, if cold worked to 170,000 psi at –105 F, by means of a reduction of only 23%, the ductility is still 20%. And if the temperature is –320 F, a reduction of 15% produces the same high strength, while the ductility is actually 25%. In other words, the lower the process temperature, the higher the ductility of the metal for the same strength, which aids difficult forming.

All of the austenitic stainless steels respond to sub-zero treat-

COMPARATIVE RESULTS of bending cold-rolled stainless at various temperatures. *Left*—bent at 775 to 800 F; *center* —at room temperature, and *right*—after cooling in dry ice



ALL AUSTENITIC STAINLESS STEELS gain strength rapidly when rolled at a sub-zero temperature; in this case –105F



TYPE 302 STAINLESS (18-8) rolled to 130,000 psi yield strength has about the same ductility regardless of process temperature, but the ultimate strength increases

ment. Type 301 gains most. The improvement in type 302 is so great that it is likely that this grade will come to the fore in design of economical lightweight parts, and that type 301 will be applied to cases where the highest strength must be obtained.

There is another aspect to the matter. The shop does not have to start with annealed material. The product may call for a stiff panel with a difficult bend, or a cold-drawn wire to be bent or coiled into a form that would normally crack if made at room temperature, or a tube requiring a sharp bend. But it's a fact that 1/4 or 1/2 hard, or other tempers, respond to sub-zero treatment. All the fabricator need do is to put the work into a cold chamber, bath or walk-in box at the proper temperature:

Note: commercial refrigerators are made by several manufacturers for temperatures down to –150 F or lower. The cited temperatures are secured by means well-known in many shops—solid carbon dioxide plus alcohol, chloroform or carbon tetrachloride for –105 F and liquid nitrogen for –320 F.

As long as the work is sufficiently cold, neither the tools nor the atmosphere surrounding the work need be artificially chilled.

Naturally the material must be worked as soon as possible after removal from the cooling bath. However, this is not a critical situation, because stainless is a low conductor of heat. Before each succeeding pass, the metal should be chilled again to remove heat generated by working. At the end of processing the metal may be allowed to come to room temperature naturally.

VIBRATION-CLEANING UNIT developed by Bell production engineers to remove chips, metal dust, and other foreign matter from complex valve bodies is assembled from standard, commercially available units. Cleaning fluid is circulated through three filters

SUPPORTED ON VIBRATOR TABLE with special fixture, valve body is connected to cleaning-fluid circuit with flexible hose, then oscillated at 10 to 55 cps through approx 0.100-in. displacement for 10 to 15 min while 1 gpm of fluid is pumped through circuit

High-speed vibration cleaning boosts valve life

When you've got a tricky cleaning job with intricate passages and blind holes, try this unusual but simple method

ROY ARMSTRONG
PRECISION VALVE SHOP,
WHEATLAND PLANT
BELL AIRCRAFT CORP

Removal of all foreign matter, chips, and metal dust from bodies of the complex valves used in servo-control, hydraulic, and fuel systems of aircraft and rockets is essential to their long life. Even minute metal particles will cause pistons to stick, and small orifices and nozzles to clog. Some orifices are as small as 0.004-in. ID. Another difficulty resulting from incomplete cleaning is the rapid accumulation of metal particles on the magnetic motors used in some valves—this causes a material reduction in motor efficiency.

Valve bodies have numerous passages, blind holes, and right-angle channels that defied all known methods of cleaning. Grinding dust, burring chips, lapping residue and other magnetic dirt would be left in some pockets. Such production methods as degreasing, ultrasonic cleaning, use of watchmaker's cleaning equipment, and even hand cleaning procedures, proved inadequate, time consuming and too expensive.

Extensive tests showed that adequate cleaning could be achieved inexpensively by vibrating the valve body while pumping clean, filtered hydraulic oil through the passages. Vibration cleaning can be accomplished with relatively simple equipment, is much less expensive, is not difficult to operate, and is easily adaptable to either laboratory or production needs.

Units now used in several Bell production departments are of simple construction. All components are purchased from recognized vendors. The main unit is a standard Model HA All-American vibrator table mounted on a welded-steel base. It has a manually adjustable frequency output range of 0 to 60 cycles per second; an automatically adjustable range of

10 to 55 cps. Total displacement is adjustable from 0 to 0.125 in.

The cleaning fluid circuit consists of a standard Model C, Type 216 Sprague pump, a 5-gal reservoir, three different filters, and necessary tubing and flexible hose. The diaphragm pump is operated by filtered compressed air. Cleaning oil passes through a 10-micron Skinner filter and a Bell-made magnetic cross filter in moving from the pump to the work. Used fluid passes through a Model PQ-3 Franz Ferro-Filter before return to the reservoir.

Special fixtures are used to attach the valve bodies to the vibrator table, some holding up to four bodies for simultaneous cleaning. Manifold connections are provided for hose lines.

Cleaning units are enclosed in plywood and Plexiglas housings to prevent injury to operators should bolts or hose fail from fatigue.

Cleaning procedures are simple. The valve body is clamped in a fixture which, in turn, is bolted to the vibrator table. Flexible hydraulic hose lines are connected between manifolds and the body. Air pressure is turned on, and is regulated to cause the pump to circulate approx 1 gpm of fluid through the circuit at approx 200 psi.

For most jobs, the vibrator is set at a displacement of 0.100 in. for automatic cycling between 10 and 55 cycles per sec. Cleaning is usually accomplished in a 10- to 15-min cycle—although some bodies require longer cycles.

Results of vibration cleaning have been gratifying. Inspection of magnetic filters has shown that more magnetic particles are loosened and washed out by this method than with any other cleaning process. Valves assembled with vibration-cleaned bodies operate for longer periods than do other valves, and magnetic motors stay clean longer. Pistons do not stick so readily, and orifices do not become clogged so often. Our acceptable valve ratio jumped 70% after we introduced vibration cleaning.

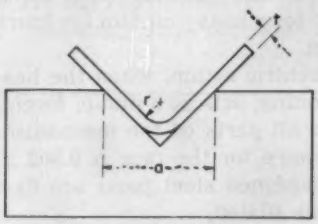
Further tests of vibration-cleaning procedures now are being made. Two possibilities being studied are:

1. We are of the opinion that by introduction of some type of fine, light abrasive in the cleaning oil, some of the minute hidden burrs inside the bodies could be removed. Polishing of passages also might be accomplished to reduce resistance to fluid flow.

2. Detergents of various kinds, including surface-tension reducers, may be substituted for the hydraulic oil now used as the flushing agent.

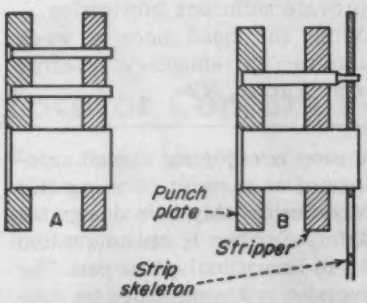
DIEMAKER'S KINKS

FEDERICO STRASSER

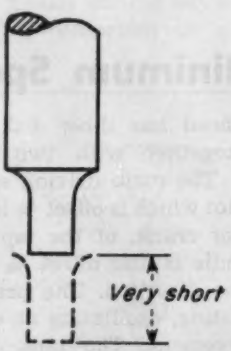


MINIMUM BENDING RADII should bear a certain relation to blank thickness and width of die opening. These empirical values have been found to give good results:

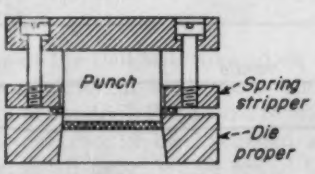
When $a/t = 10$, then $r = 1.6\ t$
When $a/t = 8$, then $r = 1.4\ t$
When $a/t = 6$, then $r = 1.0\ t$



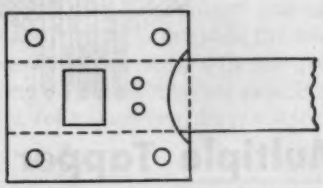
WHEN REGRINDING small piercing punches, support them in their own stripper plate, as at *A*, to avoid bending. For shouldered punches employ a strip skeleton *B*.



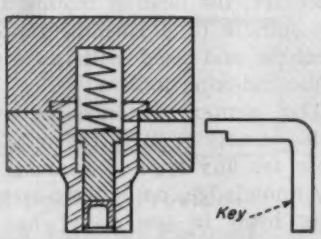
IMPACT on small punches cutting high-tensile material is reduced by making the press stroke as short as possible.



SPRING STRIPPERS often increase the load on the press by 20 to 25% of the cutting pressure required by the die. Do not overlook this fact when selecting the size of press.

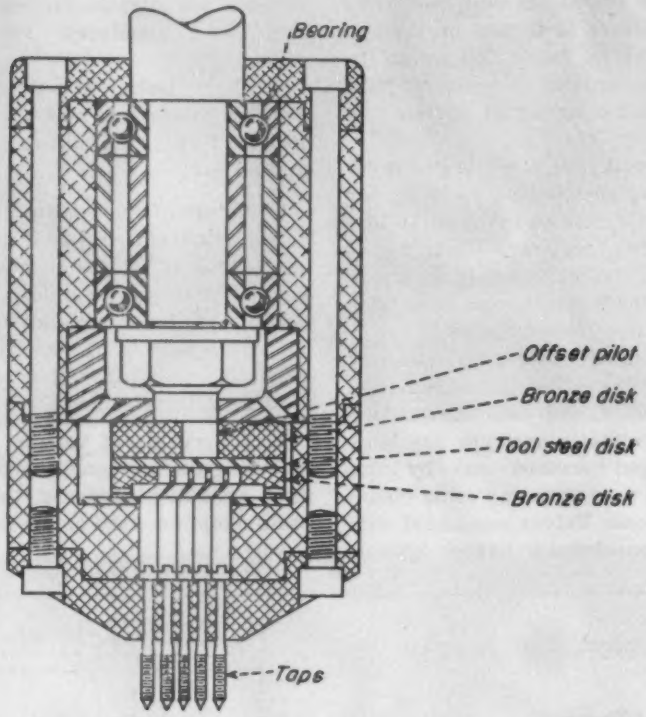


FOR EASY ENTRY of strip to a blanking or progressive die, cut away a portion of the stripper plate.



AN EMERGENCY EJECTOR for shells that remain in the die can be made in the form of a simple key. Drill a hole through die holder and die at a height where the center of the hole will coincide with the top of the regular ejector in the stuck position. Make a key from round stock to fit the hole and bent at a right angle. One end is milled to a flat coinciding with the center of the key. To remove the stuck shell and free the ejector, insert the key so the flat bears on top of the ejector. Give the key a twist.

Practical Ideas . . .



Multiple Tapper Uses Minimum Space

This device was designed to tap five holes simultaneously in a die casting that has 240 holes, 0.078 in. in dia, with 48 tpi. Three in. in diameter, the head is mounted on the spindle of a Haskins tapping machine and used with an automatic indexing fixture.

The center distance between holes is only 5/32 (0.156 in.), too close for any type of gearing. To my knowledge, no drilling or tapping head in use today has so small a center distance. This head, in use for four years, can tap at least 240 holes in two minutes.

The head has three disks fastened together with two ⅛-in. dowels. The main driving spindle has a pilot which is offset ⅛ in.; the throw, or crank, of the tap-driving spindle is also offset ⅛ in. in the same direction. The principle is a rotating, oscillating or eccentric movement. The taps, which have a specially designed shank for driving, can be replaced by removing the cap.

The head runs at 1200 rpm without vibration, in a bath of special SAE 20 lubricant. One disk is bearing bronze; a second is tool steel, hardened, ground and lapped acting as a thrust plate for the ends of the tap spindles. The third is a driving plate for the tap spindles, also of bearing bronze. The crankpin of the tap spindle is ⅛ in. in dia. Two other disks are tool steel, hardened, ground and lapped.

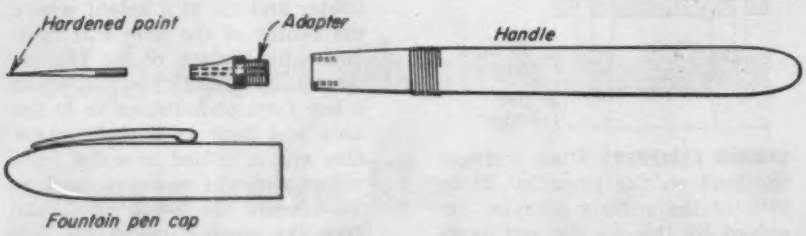
Four grooves in the bottom face of the tap-spindle driving plate allow spindle lubricant to enter. Four angled holes in the disk allow lubricant to enter the oscillating cavity.

The diameter of the tap-spindle shank is 0.144 in., and the hole in the plate is 0.145. There is, therefore, only 0.001 in. between spindles. An oil hole is drilled through the main body and outer ball-bearing spacer, and tapped for a ⅛-in. pipe plug. A ⅜-in.-dia cold-drawn steel bar is fastened to the main body to prevent the head from turning. Running clearance between the disks is 0.005 in. to allow for a heavy oil film for lubrication.

Eccentric action, when the head is running, acts as a pump, forcing oil to all parts of the mechanism. Clearance for the taps is 0.002 in. All hardened steel parts are flash chrome plated.

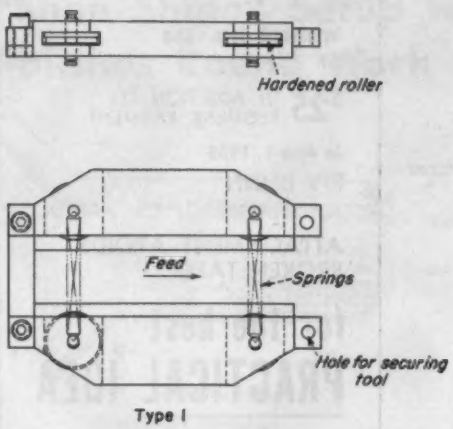
The upper end of the main driving spindle is made to fit the tapping-machine spindle. A round hole to clear the tap spindles is bored about 0.010 in. larger for clearance. A slight seepage of lubricant works down past the tap-driving spindles and the tap shanks to provide sufficient lubrication.

Oiling the head once a week maintains its efficiency. *George Oliver, Warren, NY*



Scriber Aids Safety Record

Our shop is enjoying a good safety record as a result of using this Safety-Scriber. My own design for a Safety-Scriber is an adaptation of an ordinary ball-point pen. The conversion is accomplished by substituting a ⅛ in. R & D hardened point and a 7/16-in. drillrod for the pen's original writing parts. *Rudolph Schmitt, St Albans, NY*



Strip Guides Are Built Into Press Tool

These two strip guides, which can be used on any strip width by simply altering the spacer bars, were designed to be built onto the press tool at the entry side. Type 1 presses the strip against the back rollers and can be used for all types of blanking and piercing tools where it is not necessary for the pierced holes to be equidistant from the strip edges. Type 2 is used for centralizing and guiding the strip where pierced holes must be kept equidistant from the strip edges.

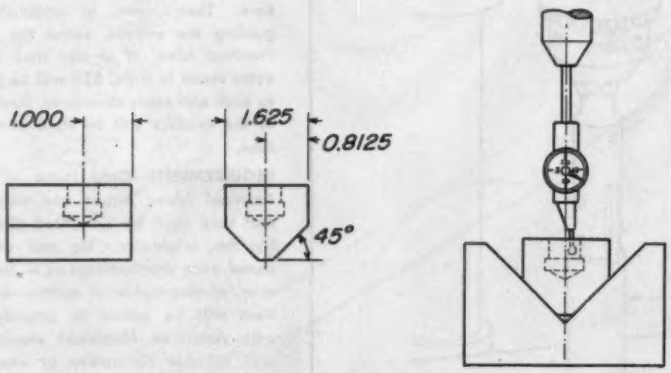
The guides consist of a standard unit, comprised of a housing, hardened rollers and tension springs.

To make a type 1 guide, the holes for the pins carrying the rollers are slotted in one unit only. The complete unit is then bolted to the bottom bolster or die of the press tool; a spacer bar is fitted to the other end of the unit to keep the rollers at the desired width.

To make a type 2 guide, a spacer bar is fitted to both ends of the units, which must be free to swing on the shoulder of adjoining screws. Another pin, the fulcrum, is in the center of the spacer bars. This pin can be fitted either in the stripper plate of the tool, or on an outboard support from the press.

In use, the bars swing on the fulcrum pins and keep the roller units parallel at all times, provided strip is accurately slit.

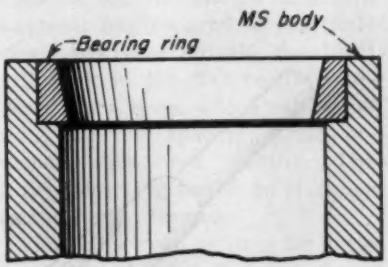
For narrow strips it is possible to dispense with the rollers and use the hardened bars to guide the material. This, however, will not give as long a life as the rollers. *P V Dunn, Johannesburg, South Africa*



Locator Centers V-block

Very often it becomes necessary to locate a hole or pin exactly in the center of a V-block. This "center locator" makes it a simple matter.

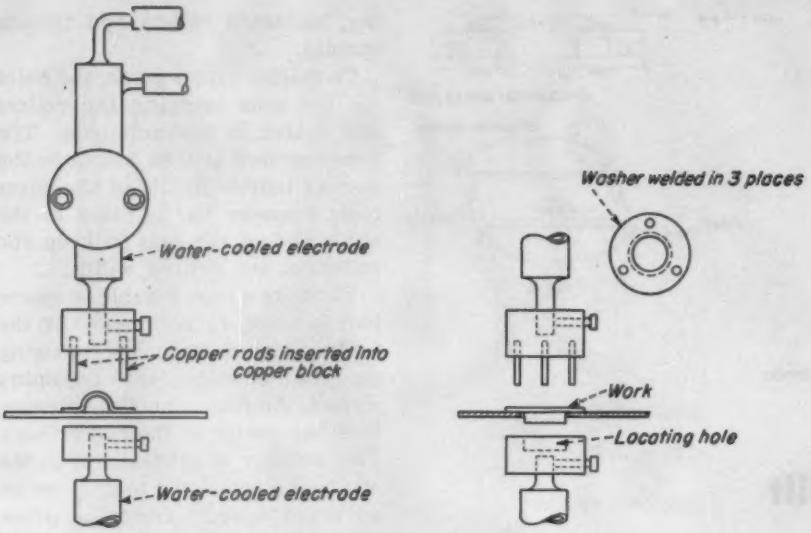
Just drop the tool into the V-block, then pick up the hole with the dial indicator. Finishing one end of the tool to a definite dimension will help hold the hole to a close tolerance lengthwise. Accuracy of the tool will depend on the concentricity of the hole to the V sides of the tool. For accurate work, the tool should be hardened and ground all over. We've found that ordinary operators have no difficulty using this tool, which has proved to be a great time saver for us. *Lester Albrecht, North Olmsted, Ohio*



Bearing Race Provides Chuck Tapered Element

Recently, while building a large special collet chuck, we substituted a Timken roller bearing race for the hardened steel ring called for in the drawings. The bearing race, inserted for the taper-closing surface, provided us with a replaceable piece with excellent heat treatment and hardness.

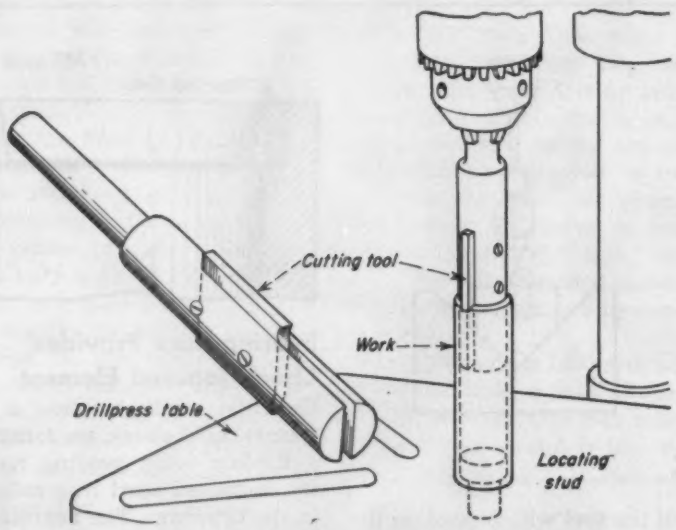
The collet was made to fit the Timken angle. Replacing the 4-in. ring made a worthwhile saving, without a loss of efficiency. *John Blaker, Auburn, Mass*



Special Heads Speed Welding

Output of resistance-welding machines can be greatly increased by making special heads right in the shop. The heads can easily be attached to the machines' regular water-cooled electrodes.

Shown here are a bracket, spot welded in two places, and a washer, spot-welded in three places, both done more quickly as a result of using special heads. *Fred Lettino, Astoria, NY*



Deburring Tool Shop-Made Simply

The tool sketched here was most effective in removing burrs from short-length brass tubing ends recently cut in our plant. It was made from a 4½ in. piece of cold-rolled shafting with a 3/32 in. slot milled from one end. Two notches with cutting edges were filed in a piece of 3/32 in. tool steel which was clamped in the slot. The tool was then spun at a high speed. *Stanley Clark, East Bradenton, Fla*

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PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

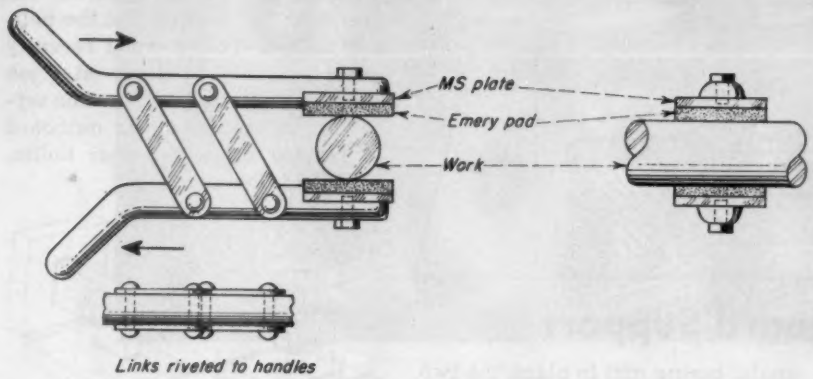
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

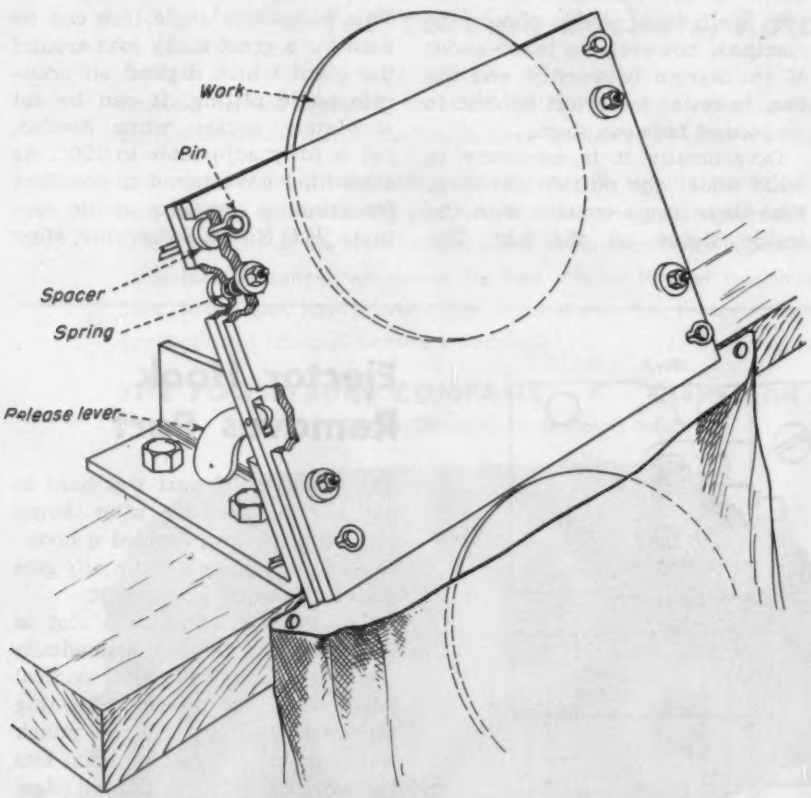
HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

"Shoe Shine" Setup With Emery Pads Polishes Round Work Safely



The tool shown here is an effective means of finishing external diameters. We made it at low cost, to polish a number of hardened shafts. It provides a safety measure for finishing, because it does away with the dangerous practice of wrapping emery cloth around the work.

The movement of each part of emery on the tool is parallel. To operate the tool, the handles are moved as shown. When the top handle is drawn toward the operator, the tool applies pressure to the work. When pressure is in the other direction, the tool is released. *W I Morgan, Somerset, England*



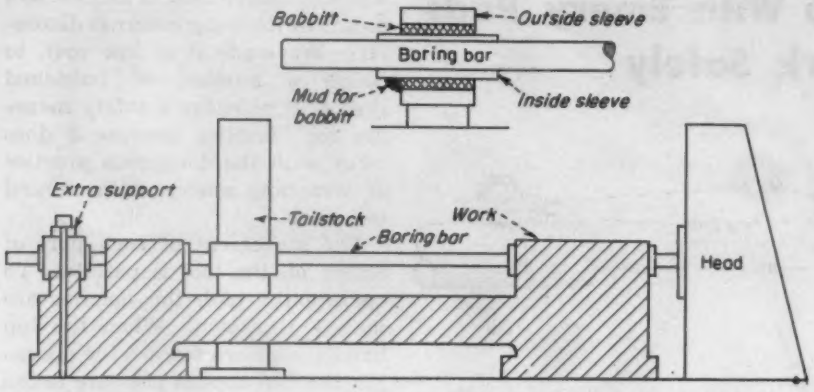
Gap Checks Plates For Flatness

Checking stamped or cut-out disks and dial plates for flatness with the normal three-point mounting method is a slow and tedious job. This new fixture can, in many cases, speed up such work by as much as ten times.

The fixture consists of two steel plates ground perfectly flat on their facing surfaces. One plate is held by angle brackets at about 60° to horizontal. The pins, normally located below the fixture, but shown above it for clarity, hold the facing surfaces of the plates close together.

The thickness of the spacers depends on the dials to be tested and should be the thickness of the dial plus the flatness tolerance. The dials are slid through the fixture from the top and can be caught in a canvas bag secured to the table edge. Any dial outside the limit will stick in the fixture until released by a lever which raises the plate off the spacers (thus increasing the gap width). The faulty dial is grasped as it drops through the fixture.

This fixture can be used for quite fine flatness limits. *E Jones, Kent, England*



Babbitt Makes Outboard Support

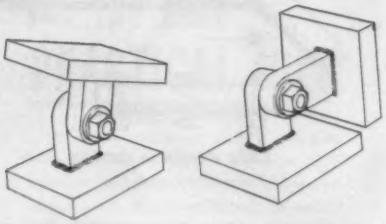
In running a horizontal boring machine an extra boring-bar support is often needed. We've found a remedy for this problem by using two cast-iron sleeves.

Making the sleeves is quicker and more economical, of course, than constructing a regular bar support. We bore one of the sleeves for a running fit on the boring bar and the other about 1 in. diameter longer than the outside of the running fit sleeve.

With the boring bar in the horizontal boring mill in place, the two sleeves are slipped over the bar to the point where support is needed. The outside sleeve is then clamped down to the machine or to the job itself. The sleeve should be clamped, however, to leave about ½ in. margin between it and the bar, in order to permit babbitt to be poured between them.

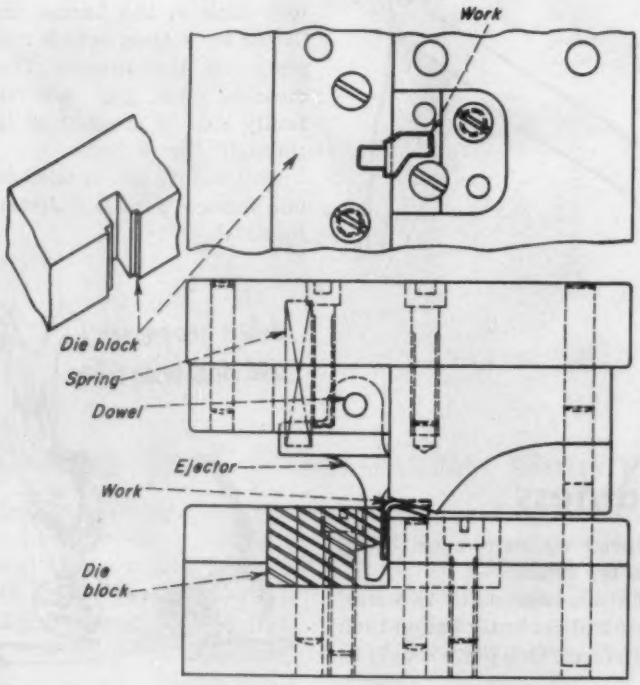
Occasionally it is necessary to build under the outside sleeve so that there is no contact with the inside sleeve on the bar. The babbitt will hold the sleeves together more firmly if they are left rough.

When the job is finished, the sleeves are slipped off and the babbitt melted. This method recently saved us about 14 hours on a job which usually took 26 hrs. The setup can be used as either outboard or inboard support. *James Rollin, Clearfield, Penna*



Angle Iron Has 190° Swing

This adjustable angle iron can be used for a great many jobs around the plant which depend on accurate angle setting. It can be set absolutely square when needed, yet is fully adjustable to 190°. As a result, I have found it excellent for grinding clearance of die sections. *H G Nicoll, Somerville, Mass*

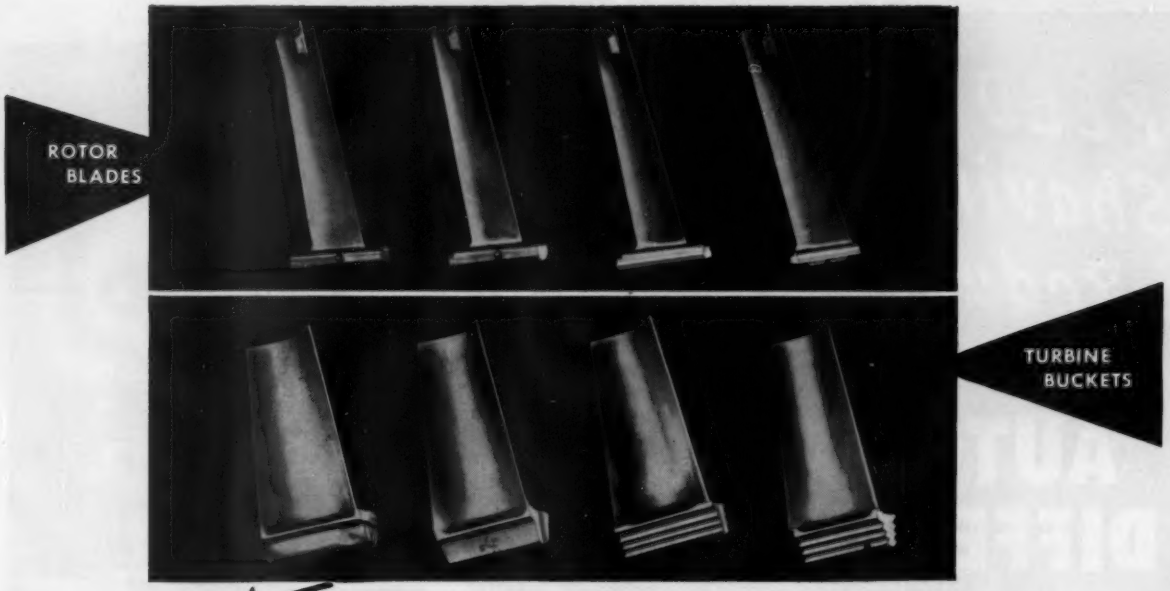


Ejector Hook Removes Part

This sheet-metal part was hard to get out of the die after being formed until we provided a hook-shaped ejector latch that really gets under the work and lifts it.

The ejector works in a slot in the die block. This slot also admits the work and holds its vertical edges while the punch is forming the horizontal leg. As the punch comes down, the ejector latch hits the work on its lower slanted edge, and rotates slightly on its dowel against spring pressure. When the punch bottoms, the latch snaps under the work, from which position it pulls the work as the ram raises again.

Action is positive and safe. *F C Elmo, Dayton, O*



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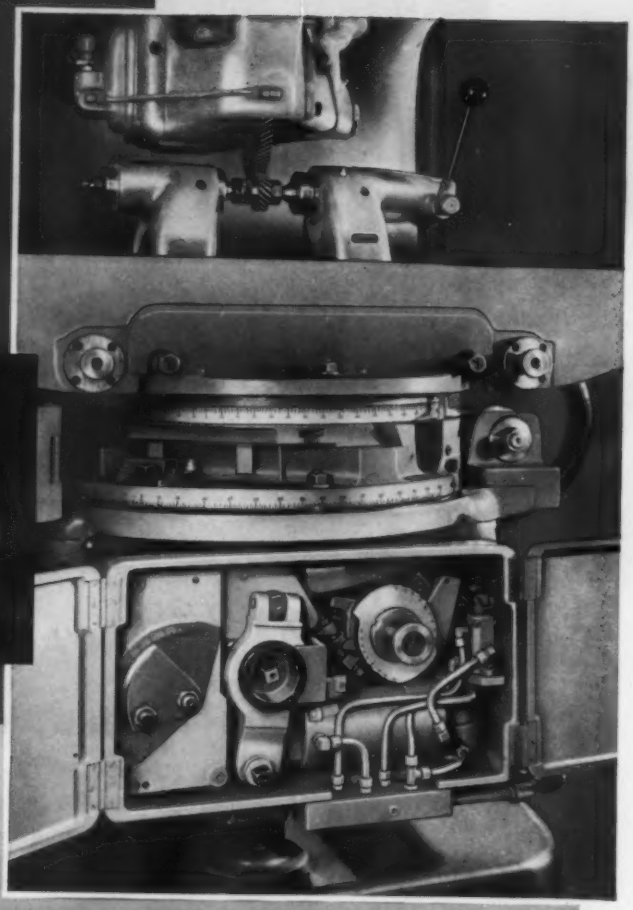

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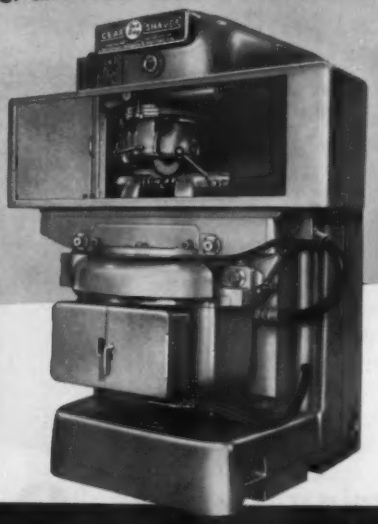

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BRAZING FILLER METALS . . . I

Reprinted with permission from the book "Brazing Manual" prepared by the Committee on Brazing and Soldering, American Welding Society, and published by the Reinhold Publishing Corp, NY

According to the American Welding Society, brazing is defined as "A group of welding processes wherein coalescence is produced by heating to a suitable temperature above 800 F and by using a non-ferrous filler metal having a melting point below that of the base metals. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction."

The proper selection and use of a filler metal is important to making a sound joint.

FILLER METALS AVAILABLE

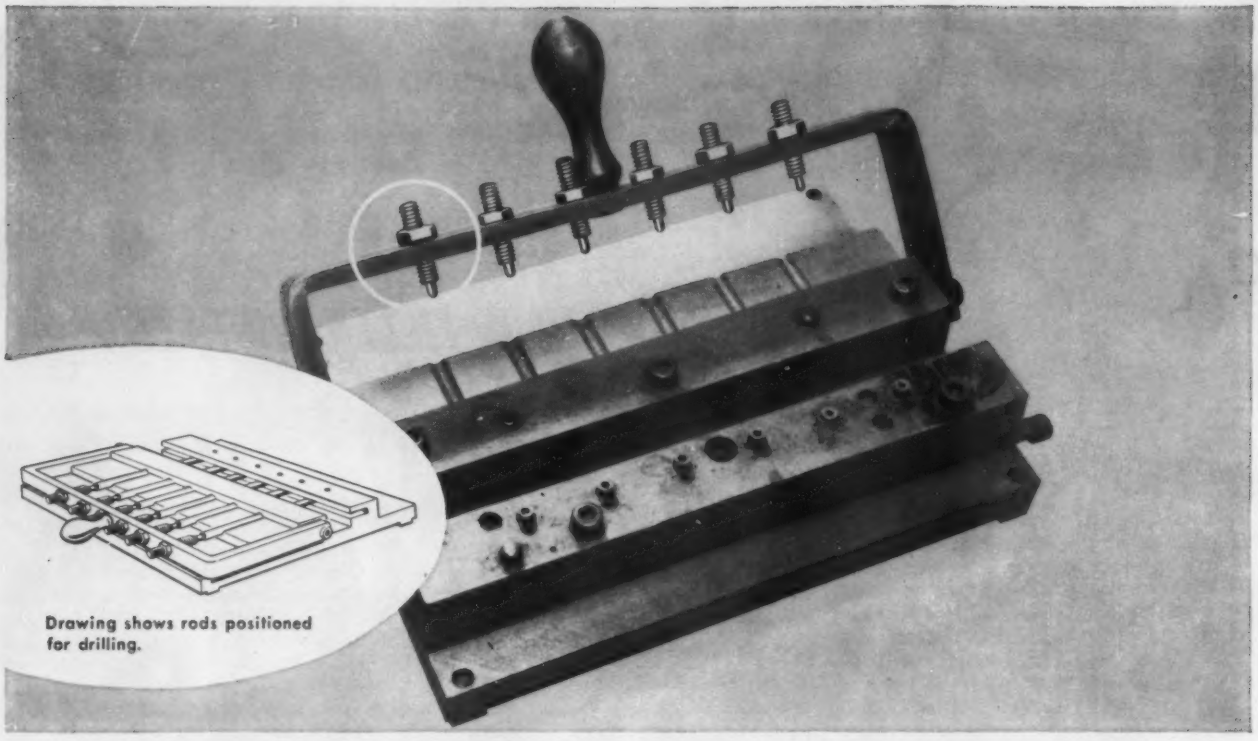
BAlSi (Aluminum-Silicon) Classifications: Brazing filler metals of the BAlSi classifications are used for joining aluminum alloys.

Correct joint clearance for a particular application is best determined by trial. Clearances of 0.006 to 0.010 in. are commonly used for laps less than ¼ in. long while clearances up to 0.025 in. are used for longer laps. Torch, dip and furnace brazing

STANDARD FORMS AND SIZES OF BRAZING FILLER METALS

AWS-ASTM Classification	Standard Form	Size, in.
Aluminum-silicon:		
BAlSi-1 and BalSi-3	Strip	0.020 by 2
	Wire in coils	Round 1/16 to 3/16
	Rod	Round, 1/16 to 1/4 by 18 to 36
BAlSi-2	Coated sheet	0.006 to 1/4*
BAlSi-4	Strip	0.020 by 2
	Wire in coils	Round, 1/16 to 3/16
Copper-phosphorus:		
BCuP-1	Strip	0.005 to 0.015 by 1½
BCuP-2	Wire in coils	Round, 1/16 to 3/16
		Square, 1/8 to 3/16
	Rod	Round, 1/16 to 1/4 by 18 to 36
		Square, 1/8 to 1/4 by 18 to 36
BCuP-3	Powder	50 to 325 mesh
	Wire in coils	Round, 0.047 to 1/8
	Rod	Round, 1/16 to 1/4 by 18 to 36
	Powder	50 to 325 mesh
BCuP-4	Wire in coils	Round, 0.047 to 3/16
		Square, 1/8 to 1/4
	Rod	Round, 1/16 to 1/4 by 18 to 36
		Square, 1/8 to 1/4 by 18 to 36
	Powder	50 to 325 mesh
BCuP-5	Strip	0.003 to 0.025
	Wire in coils	Round, 0.010 to 1/4
		Square, 1/8 to 1/4
	Rod	Round, 1/32 to 1/4 by 18 to 36
		Square, 1/8 to 1/4 by 18 to 36
	Powder	50 to 325 mesh
Silver:		
All classifications	Strip	0.003 to 0.025
	Wire in coils	Round, 0.010 to 3/16
		Square, 1/8 to 3/16
	Rod	Round, 1/16 to 1/4 by 18 to 36
		Square, 1/8 to 1/4 by 18 to 36
	Powder	50 to 325 mesh
Copper-gold:		
BCuAu-1 and BCuAu-2	Strip	To order
	Wire in coils	To order
Copper and copper zinc:		
BCu, BCuZn-1, BCuZn-2, and BCuZn-3	Strip	0.004 to 0.025
	Wire in coils	Round, 0.003 to 1/4
	Rod	Round, 1/16 to 3/8
BCuZn-4	Grain	3 to 40 mesh
BCuZn-5	Grain	3 to 70 mesh
BCuZn-6	Strip	0.006 to 0.025
	Wire in coils	Round, 1/16 to 1/4
	Rod	Round, 1/32 to 1/4 by 18 to 36
BCuZn-7	Strip	0.006 to 0.025
	Wire in coils	Round, 1/16 to 1/4
	Rod	Round, 1/16 to 1/4 by 18 to 36
	Powder	40 to 180 mesh
Magnesium:		
BMg	Wire in coils	Round, 3/64 to 3/16
	Rod	Round, 3/64 to 3/16 by 18 to 36
Heat-resisting materials:		
BNiCr	Strip	0.005 to 0.020
	Wire in coils	Round, 1/16 to 1/8
	Powder	325 mesh
BAgMn	Strip	0.003 to 0.025
	Wire in coils	Round, 0.010 to 1/4
	Rod	Round, 1/16 to 1/4 by 18 to 36

**Coated on one or both sides; coating varies from 5 to 10 per cent of the thickness of the base metal sheet; several aluminum-alloy base metals are available.*



Drawing shows rods positioned for drilling.

How to spread the profits on a sandwich jig

Ready-made Vlier Spring Plungers eliminate costly "home-made" devices; provide accurate, pre-set end pressures

The sandwich-type drill jig shown above demonstrates a typical application for Vlier Spring Plungers. Six Standard-nose models are used to locate cylindrical parts until the top of the jig can be positioned securely for the drilling operation.

There are probably a dozen similar applications in *your* tool room where these handy, precision tools can save money. They're now widely used in all industries for positioning parts in jigs and fixtures, breaking oil seals and ejecting parts from punch press dies, as detents, in end product applications—*wherever constant, accurate spring loads are needed.*

MACHINED TO CLOSE TOLERANCES

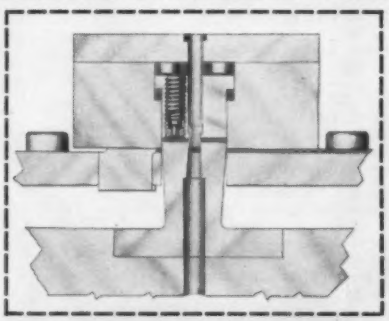
Vlier Spring Plungers are simple tools, carefully designed and manufactured to give years of service. Large bearing surfaces between the plunger nose and the body assure perfect alignment of the plunger nose at any extension. Close tolerances prevent binding and wobble, assuring smooth travel of the plunger nose over its full length. The tool is so designed that the plunger nose telescopes completely, permitting the tool to be used where mating surfaces must be flush.

SOFT CORE MINIMIZES FRACTURING

Case hardening the plunger nose gives it extremely good resistance to wear. However, the core remains ductile, overcoming brittleness and the hazards of fracturing under impact which is common with hardened, high-carbon steels.

EASILY INSTALLED OR REMOVED

Installation of Vlier Standard-nose Plungers is quickly accomplished with a simple spanner-type wrench. Adjustment of the Hexnose type is even simpler, since a standard end or box wrench can be used.



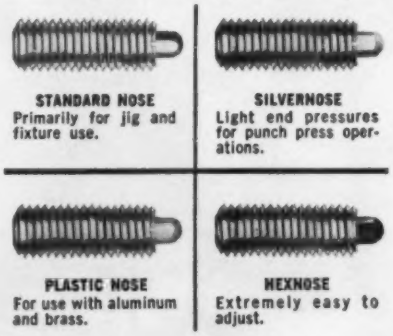
Thousands of Vlier Silvernose Spring Plungers are used in punch press dies to break oil seals and eject parts. Special springs, developed for fast, repetitive operations, give millions of flexes without crystallizing.

Providing your tool engineers with a selection of these ready-to-use tools will speed jig, fixture and die manufacture, and insure uniform, accurate loading, resulting in fewer rejected parts.

Your Vlier distributor carries a complete line *in stock*. Why not call him now?

Four Nose Types Available

Wide variety of diameters and lengths.

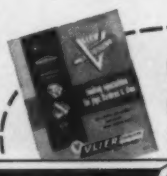


STANDARD NOSE
Primarily for jig and fixture use.

SILVERNOSE
Light end pressures for punch press operations.

PLASTIC NOSE
For use with aluminum and brass.

HEXNOSE
Extremely easy to adjust.



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BRAZING FILLER METALS . . . II

processes are most widely used for brazing aluminum although other brazing processes are also employed. The use of flux is essential for all processes. Because of the corrosive nature of these fluxes, the brazed parts must be cleaned thoroughly after brazing. These filler metals have good resistance to corrosion in most media.

BAlSi-1 brazing filler metal is a general purpose filler metal for torch, dip and furnace brazing.

BAlSi-2 brazing filler metal is available only as a cladding on M1A and J51S aluminum alloy core sheet, coated on one or both sides. It is recommended for dip and furnace brazing.

BAlSi-3 brazing filler metal is a general-purpose filler metal for dip and furnace brazing.

BAlSi-4 brazing filler metal is a general-purpose filler metal used in some cases for its relatively high corrosion-resistant properties. It is recommended for torch brazing but also may be used for furnace and dip brazing.

BCuP (Copper-Phosphorus) Classifications: Brazing filler metals of the BCuP classifications are used primarily for joining copper and copper alloys with some limited use on silver and molybdenum. Because their phosphorus content will form brittle iron or nickel phosphides, these filler metals are not recommended for ferrous or nickel-bearing metals. They may be applied by all brazing processes and may be used without flux for some applications on copper and silver. However, better results may be expected when a flux is used. Flux is necessary when BCuP filler metals are used with other metals and alloys. Joints made with these filler metals have good electrical and thermal conductivities. Corrosion resistance in most media generally is good. However, they are not recommended for use in sulfurous atmospheres above room temperature.

These filler metals have a tendency to liquate if heated slowly. It is important, therefore, especially if the filler metal is preplaced, to apply heat as rapidly as possible. The color after brazing is light gray. Immersion in 10% sulfuric acid will restore the copper color.

It will be noted in the table below, that the brazing temperature ranges begin below the liquidus. It is a basic principle in brazing that the lowest temperature within the recommended range be used, consistent with the joint clearance and the time needed to complete the braze. This in turn will depend on (1) the materials joined, (2) the brazing process employed and (3) the joint design used.

BCuP-1 brazing filler metal is used primarily for preplacing in the joint and is suited particularly for resistance brazing and some furnace brazing applications. This filler metal is somewhat more ductile than the other BCuP filler metals containing more phosphorus and therefore may be made into thin strips. It is also less fluid at brazing temperature than other BCuP filler metals. Joint clearances should be from 0.002 to 0.005 inch.

BCuP-2 brazing filler metal is extremely fluid at brazing temperatures. It will penetrate joints with very little clearance. Best results are obtained with clearances of 0.001 to 0.003 inch.

BCuP-3 brazing filler metal is also extremely fluid at brazing temperatures. Joint clearances of 0.002 to 0.005 in. are recommended.

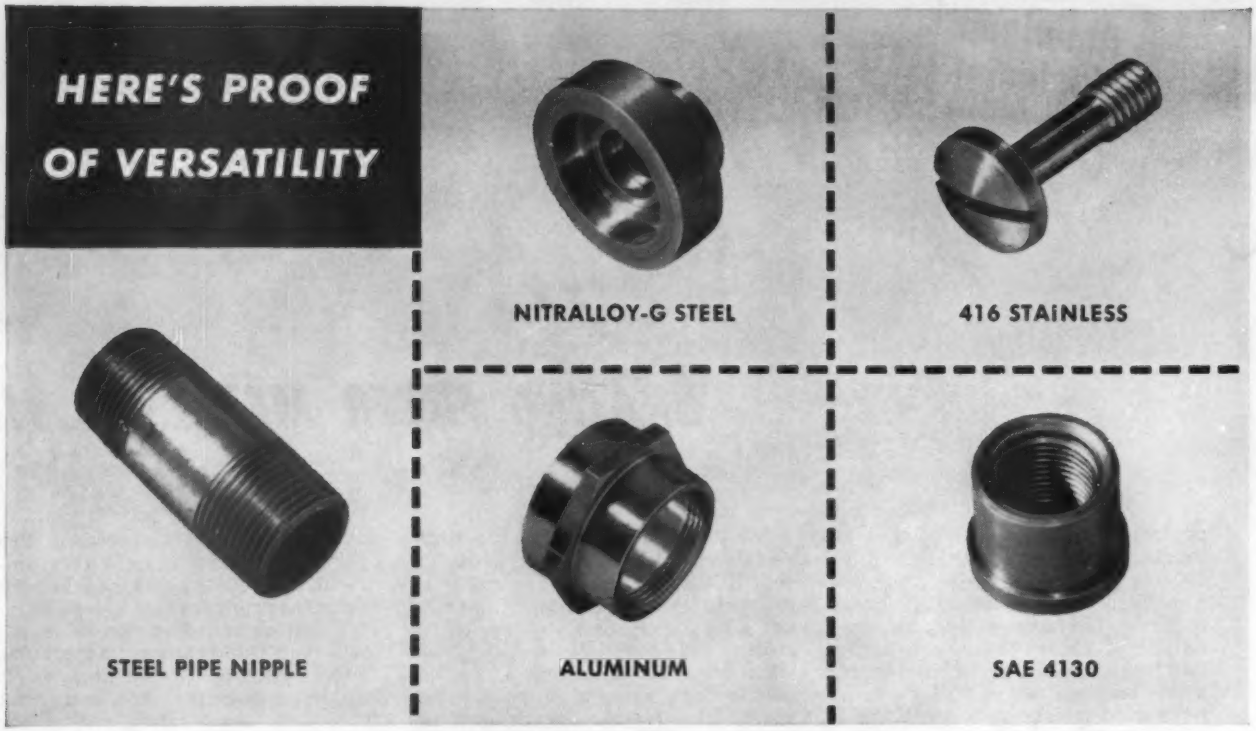
BCuP-4 brazing filler metal is best used with joint clearances of 0.001 to 0.003 inch.

BCuP-5 brazing filler metal is particularly adaptable where very close fits cannot be held. Joint clearances of 0.003 to 0.005 in. are recommended.

BAg (Silver) Classifications: Brazing filler metals of the BAg classifications are used for joining all ferrous and nonferrous metals except aluminum, magnesium and other metals which have too low a melting temperature. They are used with all brazing processes and are generally

Filler Metal Classification	Nominal Composition			Temperature, F		
	Si	Cu	Al	Solidus	Liquidus	Brazing Temperature Range
BAlSi-1	5	—	95	1070	1165	1150–1185
BAlSi-2	7.5	—	92.5	1070	1135	1120–1140
BAlSi-3	10	4	86	970	1085	1060–1185
BAlSi-4	12	—	88	1070	1080	1090–1185

Filler Metal Classification	Nominal Composition			Temperature, F		
	Cu	Ag	P	Solidus	Liquidus	Brazng Temperature Range
BCuP-1	95	—	5	1305	1650	1450–1700
BCuP-2	93	—	7	1305	1485	1350–1550
BCuP-3	89	5	6	1195	1500	1300–1550
BCuP-4	87	6	7	1185	1380	1300–1500
BCuP-5	85	15	5	1185	1500	1300–1500



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Tests have proved that new Sunicut 5534 meets this demand for an all-purpose cutting oil. It is ideal for general screw machine and turret lathe work. It is also excellent for tapping, drilling, threading, and light stamping operations. In addition, new Sunicut 5534 can be used on many special machining jobs, both high and low speed, with metals ranging from B1112 to 4130 as well as free-machining stainless steels.

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BRAZING FILLER METALS . . . III

free flowing when molten. Joint clearances should be between 0.002 to 0.005 in. For best distribution of the filler metal in the joint by capillary attraction, flux is generally required. However, for certain processes, particularly with BAg-8, if brazing is done in a vacuum or an inert atmosphere, flux may not be needed.

BAg-1 and *1a* brazing filler metals are free flowing and low melting. They are used for general-purpose work. Their melting ranges are very narrow. The color after brazing is light yellow.

BAg-2 brazing filler metal is also free flowing and suited for general-purpose work at slightly higher brazing temperatures. Its wider melting range is helpful where clearances are not uniform, but care must be taken to prevent liquation. The color after brazing is yellow.

BAg-3 brazing filler metal is used widely for joining carbide tool tips to tool shanks because of its advantage in wetting of the carbide. It has a wide melting range in which the solid and the liquid portions do not tend to separate excessively. This makes it a good filler metal for bridging gaps or forming fillets. It has generally good corrosion-resistant properties but is not as free flowing as BAg-1 and -2. Color after brazing is whitish yellow.

BAg-4 brazing filler metal is, like BAg-3, used extensively for carbide tip brazing although slightly higher brazing temperatures are required. When molten, it flows more freely than BAg-3. The color after brazing is light yellow.

BAg-5 and -6 brazing filler metals are general-purpose metals for use with higher brazing temperatures. They may be used where the use of cadmium-containing alloys might be prohibited, as for food handling equipment. The color after brazing is light yellow.

BAg-7 brazing filler metal is a general-purpose, low-melting filler metal which does not contain cadmium. It is good for furnace brazing and its whitish color after brazing makes a closer color match with whitish metals like stainless steel. It is used by the dairy and food industries where cadmium-free joints are required. This filler metal has been found to be less prone to cause stress corrosion cracking on stainless steels and some nickel alloys.

Filler Metal Classification	Nominal Composition Ag	Cu	Zn	Cd	others	Temperature, F Solidus	Liquidus	Brazing Temperature Range
BAg-1	45	15	16	24	—	1125	1145	1145-1400
BAg-1a	50	15.5	16.5	18	—	1160	1175	1175-1400
BAg-2	35	26	21	18	—	1125	1295	1295-1550
BAg-3	50	15.5	15.5	16	Ni3	1195	1270	1270-1500
BAg-4	40	30	28	—	Ni2	1240	1435	1435-1650
BAg-5	45	30	25	—	—	1250	1370	1370-1550
BAg-6	50	34	16	—	—	1270	1425	1425-1600
BAg-7	56	22	17	—	Sn5	1145	1205	1205-1400
BAg-8	72	28	—	—	—	1435	1435	1435-1650
BAg-9	65	20	15	—	-	1280	1325	1325-1550
BAg-10	70	20	10	—	—	1335	1390	1390-1600
BAg-11	75	22	3	—	—	1365	1450	1450-1650

BAg-8 brazing filler metal is used where volatile elements are prohibited as in the assembling of vacuum tubes. Although it is free flowing, it does not wet well on ferrous metals. The color after brazing is white.

BAg-9, -10, and -11 brazing filler metals are used particularly for joining sterling silver. These three metals have different brazing temperatures and can be used for step brazing of consecutive joints. The color after brazing is white.

BCuAu (Copper-Gold) Classifications: Brazing filler metals of the BCuAu classifications are primarily used for joining parts in electron tube assemblies where volatile materials are particularly undesirable. In electron tube applications these filler metals are usually used for induction, furnace or resistance brazing in a reducing atmosphere or in a vacuum without flux. For other applications a borax-boric acid flux is used. The two BCuAu filler metals provide a variation in brazing temperature to permit step brazing.

Filler Metal Classification	Nominal Composition Au	Cu	Temperature, F Solidus	Liquidus	Brazing Temperature Range
BCuAu-1	37.5	62.5	1755	1815	1815-2000
BCuAu-2	80	20	1620	1630	1630-1850

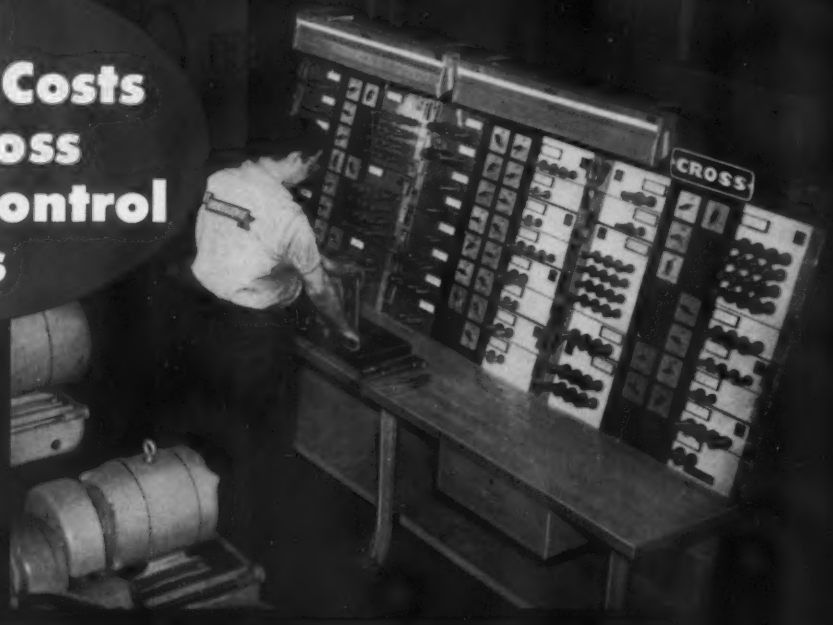
DIFFUSION OF FILLER METAL

When a brazing filler metal wets the base metal on which it is applied, there may be a diffusion of the filler metal into the base metal or a dilution of the filler metal by the base metal. Such diffusion and dilution are likely to occur when the two materials are similar in chemical composition. Factors that affect the extent of the reactions are: (1) brazing temperature, (2) length of the brazing cycle, (3) geometry of the joint as it affects the area of base metal exposed to the filler metal, and (4) composition of the filler metal. Stress cracking, or intergranular diffusion of the filler metal, is a localized form of diffusion which depends on stress present in the base metal.

(To be continued)

A Mechanical Eye...

Ford Cuts Tool Costs with Cross Machine Control Units



One of the Cross Machine Control Units at Ford Motor Company's Cleveland Engine Plant

(U. S. Patent Nos. 2679038 and D-163935. Others pending).

According to records, 221 Cross Machine Control Units in operation at Ford Motor Company Plants are assisting them greatly in improving tool trouble conditions.

One reason for this is that the Machine Control Unit provides a definite and convenient place for storing tools . . . tools which are pre-set so they can be placed in operation immediately without making machine adjustments.

Another reason is that the Cross Toolometer, an integral part of the Machine Control Unit, provides a standard for the performance of the tools, thereby enabling corrective action to be taken when necessary. The Toolometer dial is set to indicate the number of pieces which a given tool should produce. When the dial has reached that pre-determined figure, the machine automatically shuts down and the tools are changed. At the same time, other tools indicated by the Toolometer as approaching the end of their usefulness are also changed to take full advantage of the machine shut down.

The Cross Machine Control Unit is helping to keep Ford production going and is also assisting greatly in controlling tool life.

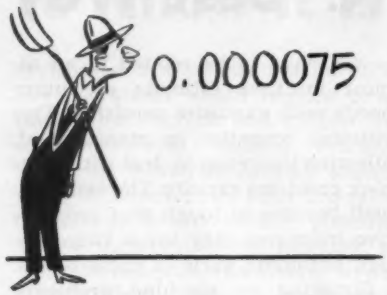
Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Talking Shop . . .



Green Men

TIMKEN ROLLER BEARING has recently opened a 150-man plant making tapered roller bearings at New Philadelphia, Ohio. Lighting is 30 fc, temperature held at 75 F, and production tolerance is 75 millionths. To attain this tolerance, Timken recruited local people and farmers, the idea being that it is easier to train green help than to retrain skilled men. We've heard that one before—and there is apparently considerable truth in it. One instrument maker we know employs youngsters; when they begin to figure out ways of doing their jobs easier, he sends them on to nearby production plants as well-trained men. His explanation: "All the mistakes here must be in the same direction. When a man begins to think for himself here, two things happen: he makes his own mistakes in addition to mine, and he finds out the unbelievable accuracy to which he is working—and that scares him. Those two discoveries make him a better machinist, but a lousy man for me."

Automation

ONE PITFALL in automation is the indexing transfer device in which one missed pocket thereafter is a missed carrier all the way along—reducing final output by that vacancy. Here is another reason for banking devices between machines. Further, automatic lines should be built around standard machines if possible, reducing engineering cost and shutdowns for repair, and requiring special engineering only on the automation units. Most modern machine tools can be modified easily for automatic control. Cincinnati Milling is using the force of gravity to fill work loaders, hoppers, etc, from non-indexing conveying means like belts. On a grinder setup for stepped armature shafts, Cincinnati had the loader use cascade rails, upper and lower, to keep the shaft rolling crosswise down the chute. Limit switches then controlled release of a shaft from the magazine position to an elevator that placed the part between centers and made sure that the foot stock was properly engaged before grinding commenced.

Other types of gravity chutes have been developed for more complex parts like steering knuckles and rear-axle pinions.

Part jams in chutes, especially when light parts with interfering elements are fed, may be avoided by an air-blast assist. In assembling two plastic parts loaded into separate chutes and feeding to a dial machine (Bodine), the chute must turn over the part, because it can't be fed bottom up by a vibratory feeder (Perry Equipt & Engrg). So the chute had an opening where an air blast could play to make the pieces fall over and keep them separated enough to do so.

The feeding of parts for roll flowing of tapered shells and the like (as by Floturn process) will be speeded by a stack feed or hopper. The blank will drop to a centering device and be gripped on the edges by grooves in the centering blocks on the roll holders. This development, plus automatic stripping, is expected to achieve production rates as high as 1000 pph.

Telling the World

ONE OF THE MOST UNUSUAL advertisements we've ever seen is the one by GE (*AM*—Sept 12 '55, p80-81). In this GE gives credit to its subcontractors for the fine job they have done and suggests the kind of work they can do for others. Now that many contracts have expired, quite a few of these small outfits have surplus capacity. GE tells what type of work they can do, their facilities, and their record on precision and delivery. It's a practical way of saying "thank you," and an outstanding goodwill producer.

Costly Comparison

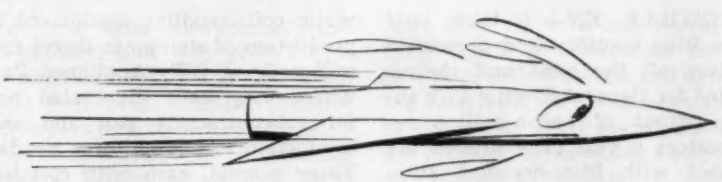
ACCORDING to an analysis by Panavision, Inc, Los Angeles, parts for its movie-camera lenses can be die-cast to save 56%, at the same time cutting tooling cost 55% and machining cost 80%. Molds, however, cost 600% more. Net cost on lens mounts and the like would be 25% higher for permanent-mold casting than for die casting, for sand casting 48% higher.

Stainless Curtain

SOME THOUSANDS of plates of 20-gage, type 302 stainless will face the 45-story Socony-Mobil Bldg in New York City above the fourth story. Because the building was originally to have masonry curtain walls, it is not designed in modules, hence sheathing sections must be of a variety of sizes, yet all must have a surface pattern of triangular characters in a bold repousse with sharp corner radii. Forming was done by Commercial Shearing & Stamping Co, on a single sectional die made up on a bed plate. Flat sections in the design are produced by flat die blocks on the ram meeting matching ones on the lower die, while the repousse pattern of triangles is stretch-formed against the lower male die at the same time. Each triangular pattern is formed simply by a die section consisting of three tool-steel plate wedges set on edge, and meeting at the center like ridges of a roof. This makes a lighter, cheaper and readily changeable die.

Hot Skin

AS AIRPLANES GO from twice the speed of sound (about 1500 mph) to four times it (3000 mph), the skin temperatures to be withstood will rise from 175-250 F to 1150 F. Aluminum alloys can handle twice the speed of sound, titanium three times (skin temperature 650 F), but only steel will work at four times. Herbert Hinckley, asst chief engr at Fort Worth for Convair, gave these estimates to the ASM in San Diego.



News of Metalworking . . .

AMA TALKS AUTOMATION: "Best Way

NEW YORK—Simple automation is available today for almost any machining job. But metalworking management has been slow to take advantage of its possibilities. That's the opinion of Wallace E Brainard, Hughes Aircraft Co, expressed in a talk before American Management Association's Special Manufacturing Conference on Automation at the Hotel Roosevelt here October 10-12.

Automation consists of four parts, he noted. First comes operations engineering, which can't as yet be shortcut. Next is data storage, which has been handled for 100 years by player-piano rolls, for less time by cams, and just recently by tape and punched cards. Third is machine motion, easily handled by mechanical, hydraulic, or air power. Last comes feedback, to check results against aims; but this part isn't always necessary, so automation is not as complex as some suppose.

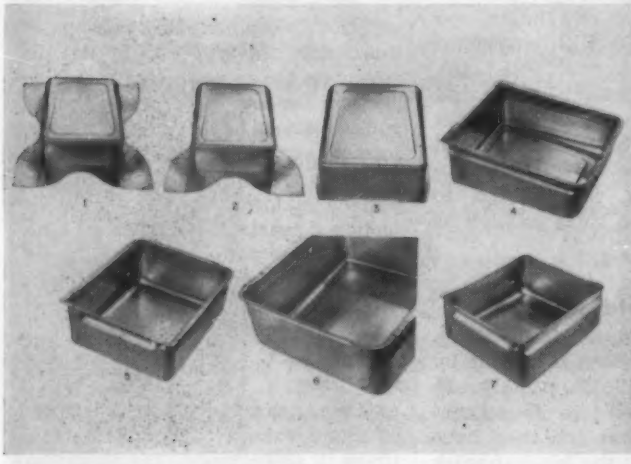
As for numerical control, he suggested it's a matter of "decimal addresses"; one answer to the universal problem of location.

Stiffer Demands on Planning

Opening the meeting, Robert K Mueller, Monsanto Chemical Co, keynoted future management problems, which will require much higher development of training and cooperation within plant organizations, caused by automation's stiffer demands on planning. Management factors—men, machines, money, etc —will have to be related to an almost faultless estimate of future needs with exquisite precision. This requires empathy in management, allowing the group to deal with complex problems rapidly. The task may well become so tough that prospective managers may think twice before becoming parts of these teams.

Speaking on machine problems, David N Smith, Jones & Lamson Machine Co, reported that automated machines are actually systems Where the normal machine price is $8-10,000, as much as 10 times that amount may go into controls, gages, handling devices, and the like before that system will operate completely. Controls go three places—into input, internal, and output sectors of the

GE's Three Transfer Feed Presses Turn Out



Sequence of operations . . .

in making refrigerator crisper pans is (1) cut off 22 x 24 in. blank and deep draw to 11¼ in. wide x 13⅛ in. long x 5 13/32 in. deep, (2) rough trim rear of flange, (3) rough trim front of flange, (4) cam form sides of pan, (5) cam form front recess and pierce holes in sides, (6) curl rear flange and indent side flanges, (7) finish trim rear flanges

Coils are loaded into cradle . . .

to start operations. After attendant threads coil end through 5-roll straightener and into roll feed, operation is entirely automatic. A second coil, held in a tilted load table, is lowered into feed position by air cylinders, when needed, to cut handling time between coils. Coil handling on this 800-ton press, which makes shelves, is essentially same as on 800-ton shelf line

LOUISVILLE, KY — It takes only three Bliss transfer feed presses to produce all the pans and shelves needed for General Electric Co's annual output of half-a-million refrigerators a year. The presses are coupled with Bliss-designed automatic coil handling equipment for production of stampings direct from mill coils at GE's Appliance Park, where they have eliminated need for subcontracting pan and shelf production to two or three vendors. Three presses, each with coil handling equipment, are involved: a 700-ton, 7-station press that turns out 12 deep-drawn refrigerator pans a minute, and feeds them off onto a conveyor automatically; and two identical 800-ton, 6-station presses equipped with coil cradle, straight-

to Know It Is to Use It" Management Told

systems. A flexible machine for various operations would require complete input controls and simpler internal controls. Output controls would be minimum because gaging many different parts with the same equipment is not usually possible. For a high-production machine to work on one part, the system would require simple input control, complex internal control, and complex output controls, including feedback gages. In all cases, the machine and controls must be compatible.

He reported that sales of automated machines, including those with numerical control, are mostly now going to large experimental departments to educate user companies to the problems involved.

Mr Smith also predicted that selective assembly may well be supplanted by a system that controls one component (for example, the ball diameters for bearings) from results with others (inner and outer races, in this case). Balls would be cut to the right dia to fit the race dia being produced. This would result in poorer individual-part quality, but better assembly quality.

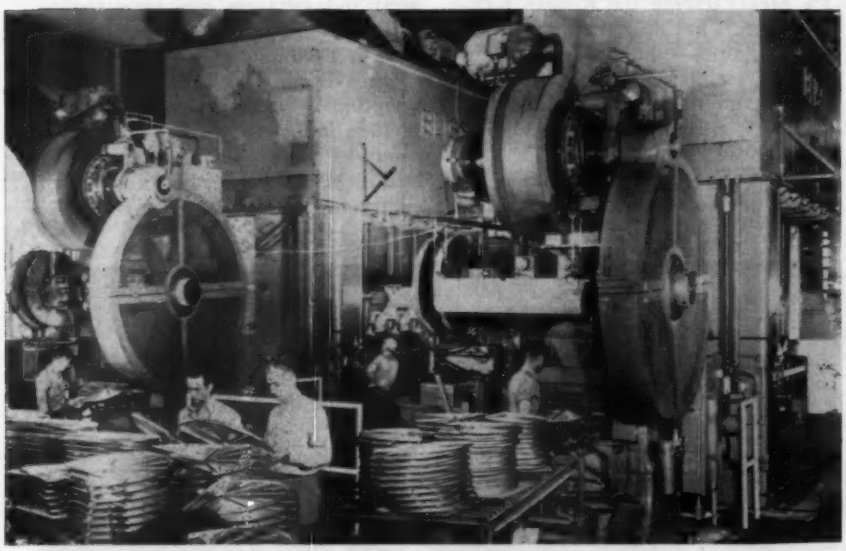
Paul Maker, Bryant Chucking Grinder Co, stressed automatic quality control as a part of automation; requiring machine adjustment on a statistical basis. Where computers are used, they could be simple, because normal-frequency curves could be worked out ahead of time, and results compared with theory during production to control size drift. He added that pressure for workloaders has come from buyers, but more complex control has stemmed from machine builders.

Albert F Sperry of Panellit, Inc, noted that greater gains may be attained from machine utilization than from labor savings. The process industries (chemical, oil) are getting to the point where reducing manpower is increasingly difficult, but where complete knowledge of all factors and effects in the process is still hidden. The answer will be more knowledge; a result of better equipment and controls.

Charles F Hautau spoke on machine utilization, noting that the

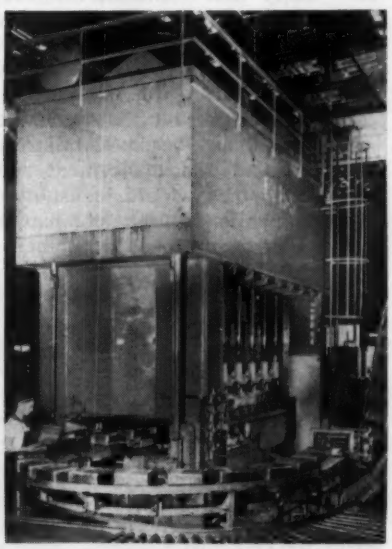
(Continued on next page)

Pans and Shells for 500,000 Refrigerators a Year



End of the line . . .

for shelves are these smaller presses at the end of the 800-tonners. Here shelves are fed automatically from transfer press to the embossing press, hand unloaded and reloaded onto conveyors for further processing. Both embossing dies and transfer feed dies are Bliss-built



Pan pressing . . .

on this 700-ton press is similar to that for shelves. From here, pans go to the pickling and enameling departments

ener and roll feed. Each produces rotary and stationary shelves at a rate of 15 per minute from mill coils. On all three press lines, standard mill coils up to 6000 lb, 54-in. dia, 22 in. wide are loaded onto the coil cradle. Coil winds off cradle at desired rate, through a 5-roll straightener, and into press's synchronized roll feed. Then strip is cut off at first press station. Transfer feed fingers pick up workpiece, carry it to next station. As press slide descends, fingers move out; as it rises they move in and repeat the cycle. Cycle is continuous, feeding new strip to first station and delivering completed part with each stroke of the press. Total installed cost of the presses, coil handling equipment and tooling: $1 million.

AMA on AUTOMATION (cont'd)

smaller plants are the worst examples of poor utilization. He suggested that adapting standard machine tools for high production is a poor way of solving production problems, and that special machines for special jobs was more reasonable. Important factors in machine economies during repeated cycling are: Never let spindles stop and start; never release and rechuck the part until all operations are done; put off cut-off operation until last possible second.

"Cross-Pollinization of Ideas"

One important factor in automation growth, he urged, is "cross-pollinization" of ideas, a result of travel and visiting many other shops to improve methods at home.

Speaking on requirements for advanced automation systems, Eric W Leaver, Electronic Associates, Ltd, declared that information for programming such equipment must be detailed and exact. Information preparation will therefore become more important and lengthy. It is also likely that standard information related to standard parts may be filed for reuse.

Trade-Ins Likely

He also suggested that machine replacement may become similar to private-automobile replacement, and rich companies would constantly replace, while poorer companies would buy second-hand equipment. This would require automation equipment organized in loose fashion; not tightly integrated machines.

He named three successive stages of automation: 1 (present) Only machines handle, operate on, and inspect the work; 2 Machines do that plus adjust for product changes, tool wear, and output; 3 Machines do all this plus self-inspection and self-replacement if faulty—perhaps even including self-repair.

Panel Discussion

A panel discussion with Howard Gleason, Stromberg-Carlson Co; B M Middlebrooks, Minute Maid Corp; J W Kuebler, Dixie Cup Co; and Edward W Bratton, Carborundum Co, turned up the general opinion that automation should include feedback. One interesting sidelight: Dixie Cup writes off some automation equipment over a period of 10 to 30 years; Stromberg-Carlson uses a 3-5-year period.

Two Major Steel Producers Come Up With (Almost) Nickel-Less Stainless

NEW YORK—Two of the nation's top steel producers, United States Steel Corp and Allegheny Ludlum Steel Corp, have each come up with stainless steels that require little or no increasingly-short-in-supply nickel in their makeup.

U S Steel has filed a patent application on a stainless steel containing "little or no nickel," whose properties are achieved by a re-combination of chromium and manganese content and the addition of more nitrogen. U S Steel's Dennis J Carney, electric furnace department superintendent at the South Works, Chicago, admits the nickel-free stainless needs more work on corrosion, welding and high-temperature properties, and solution of some rolling and finishing problems. But he expects these bugs will be ironed out in the near future.

Allegheny Ludlum, which offered a 15% chromium, 15% manganese, 1% nickel during the Korean nickel shortage, is not only making that alloy available—it has three other austenitic stainless steels with low nickel content on the market:

A 17% chromium, 4% nickel, 6% manganese sheet and strip alloy while it uses more nickel than the Korea-developed grade, still stretches the current supply of nickel twice as much as does the usual grade of stainless. It has desirable high strength and corrosion resistance, good formability and weldability.

AL 17-4-6 (assigned AISI Type 201) is resistant to atmospheric and other corrosive conditions where AISI Type 301 might normally be applied. Fabricators switching to this material need few if any changes in tools, dies or forming operations.

AL 18-5-8 (AISI Type 202) is an austenitic alloy developed by Allegheny Ludlum as an alternate for Type 302, has similar mechanical and corrosion-resistance properties to that material. It is now available in sheet and strip, may shortly be marketed in other forms.

Illinois Tech to Discuss "A-Bomb and Industry"

CHICAGO—Several hundred Midwest industrialists are expected to attend a conference at Illinois Institute of Technology November 17 on "The A-Bomb and Industry—a Prescription for Survival." Topics will include industrial dispersion, underground plants, strengthening of buildings, industry operation in an emergency, and saving of records.

Chase's First After-the-Flood Brass Casting

FIRST BRASS CAST at Chase Brass & Copper Co's Waterbury, Conn, came less than 7 weeks after Naugatuck River flood waters caught electric furnaces still in operation, freezing the metal right in the furnaces

MACHINE TOOLS and the GOVERNMENT:

"Let's Buy 'Em Here, Not Overseas" BDSA Advises Congress

WASHINGTON — If the Commerce Dept has its way, you're going to see the following laid down as government policy affecting machine tools:

• More restrictions on foreign bids for government machine tool orders.

• Tighter regulations on leasing of government machine tools by private industry.

• More aids to expansion of machine tool industry capacity.

That's the essence of recommendations in a Business and Defense Services Administration report to the House-Senate Joint Committee on Defense Production. The report has something to say about pooled orders, government directives and priorities, and like subjects affecting the machine tool industry.

For instance, BDSA says government procurement of machine tools from foreign builders "generally is not in the interest of national defense." The agency says the objective of the Reserve Tool Program is to broaden the mobilization base—by tool procurement from domestic builders.

Despite "strenuous efforts by importers on behalf of foreign builders," BDSA reports practically all Reserve Tool Plan procurement has been from US makers. But, says BDSA, "Some foreign tools were bought by the military . . . before first getting the views and recommendations of BDSA on whether such foreign procurement might be adverse to national security." The tools referred to in the report were bought from England and Italy by the Air Force for current use.

BDSA's report adds, "We (BDSA) believe that funds appropriated to the Defense Dept were intended not only for military end-items . . . but for maintenance of the mobilization base, both for direct military programs and defense-supporting industries, including machine-tool production capacity. The "Buy American" Act of 1933 . . . had as its primary purpose the protection of American Industry."

Regarding tool leasing by the government, BDSA wants regulations tightened by ODM as follows:

• The leasing agency should be furnished "evidence of the prospective lessee's financial responsibility and manufacturing know how."

• Equipment should be leased only for production of defense or defense-supporting industries, and "temporary production of civilian goods . . . interrupted by disaster such as fire or flood." Another exception: where government tools might be required for future emergency use at the plant of the prospective lessee and "are of such size or characteristics as to make it impractical or uneconomical to store at another location."

• The prospective lessee should certify that "procurement of adequate equipment from private sources is not available in time to meet production requirements," and that other adequate sources are not available for the job involved.

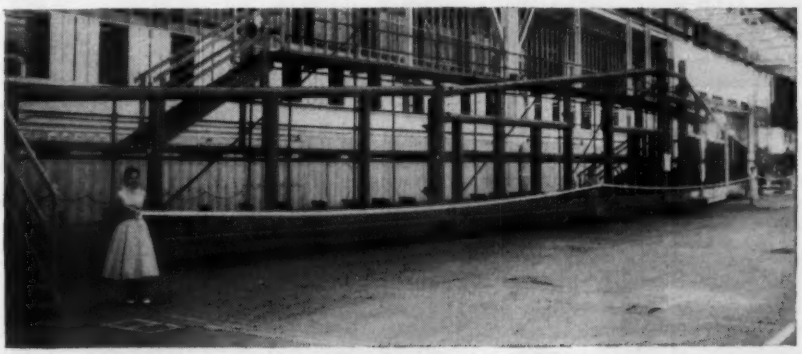
Operating at maximum capacity, the machine-tool industry would require from 1 to 9.3 years to complete estimated full mobilization requirements for metal-cutting machine tools, BDSA reports.

The report also discloses that:

• Under Order M-41, BDSA's Metalworking Equipment Division has analyzed 22 order-boards per quarter over the past year from builders of "Exhibit B" classes of tools (jig-boring machines, jig grinders, and No. 4-and-larger milling machines). During this period, the military services made 103 requests to expedite tool shipments. BDSA issued 13 diversion orders, 50 directives, and 10 special ratings in accord with the requests, plus 101 similar requests from defense-supporting users.

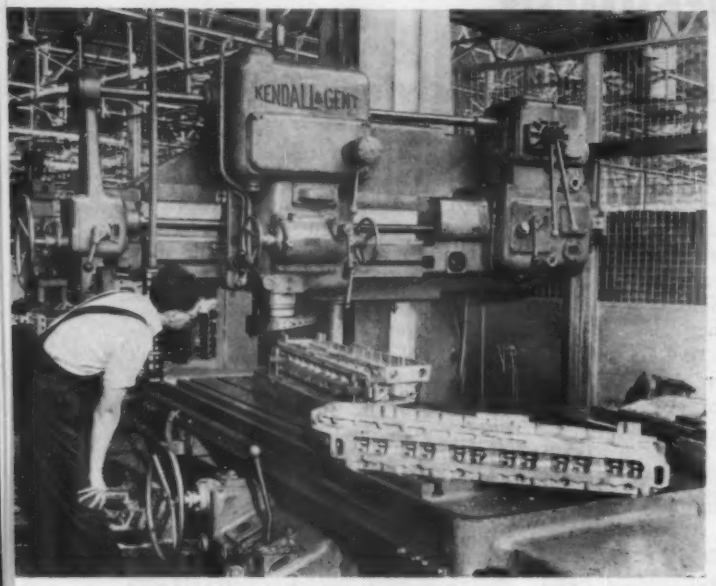
• The agency is updating its "machine tool mobilization base book records" to reflect current capacities and estimates of mobilization requirements. And BDSA is developing "machine tool fact books" that will contain alphabetical listings of all machine tool manufacturers, key personnel in each plant, materials consumption of each plant, product mixes, present production levels and mobilization capacity levels. Copies of these are being sent to the relocation center from which BDSA would operate in the event of a nuclear attack on the U S.

• Government agencies are drafting a proposed machine tool pool order program for use in any future emergency. The objective is to "buy time," place a firm contract with a machine tool builder, and allow him to work up bills of materials, facility needs, and subcontracts in advance. The report estimates the Korean military buildup was delayed 12-18 months because of machine-tool-building bottlenecks.



How Big Can You Get?

LOCKHEED CLAIMS THIS IS THE WORLD'S BIGGEST AIRCRAFT JIG. This basic mating and assembly jig cost $100,000 to build, is used for making 150-ft wings for Lockheed Super Constellations. As you see it here, the jig is only about 15% completed. The open spaces on the finished jig will contain lights, locators, tie-bars, drill plates and other precision equipment, including optical equipment that can detect 0.001-in. variations, and built-in aluminum "yardsticks" that correct expansions and contractions in the metal caused by early-morning-to-high-noon temperature variations. Jig is so big it's fitted with telephones so workmen at one end can talk with men at the other. It makes it possible to build wings with just one manufacturing joint



LUGS ON CYLINDER HEAD (left) are 2 in. high at one end but are milled off in a single pass by special progressive cutter which also finish-mills the rocker-cover surface

Cutter bit No.	Rad.	Depth
34	5⅛"	2·256"
32	6⅛"	2·384"
30	5⅛"	2·512"
28	6⅛"	2·640"
26	6⅛"	2·768"
24	6⅛"	2·896"
22	6⅛"	3·034"
20	6"	3·162"
18	5⅛"	3·290"
16	5⅛"	3·418"
14	5⅛"	3·546"
12	5⅛"	3·674"
10	5⅛"	3·802"
8	5⅛"	3·930"
6	5⅛"	4·058"
4	5"	4·186"
2	4⅛"	4·265"
Master	4⅛"	4·295"

Cutter bit No.	Rad.	Depth
35	6⅛"	2·182"
33	6⅛"	2·320"
31	6⅛"	2·448"
29	6⅛"	2·576"
27	6⅛"	2·704"
25	6⅛"	2·832"
23	6⅛"	2·960"
21	6⅛"	3·088"
19	5⅛"	3·226"
17	5⅛"	3·354"
15	5⅛"	3·482"
13	5⅛"	3·610"
11	5⅛"	3·738"
9	5⅛"	3·866"
7	5⅛"	3·994"
5	5⅛"	4·122"
3	4⅛"	4·250"
1	4⅛"	4·280"

Finish cut

"ROTARY BROACHING":

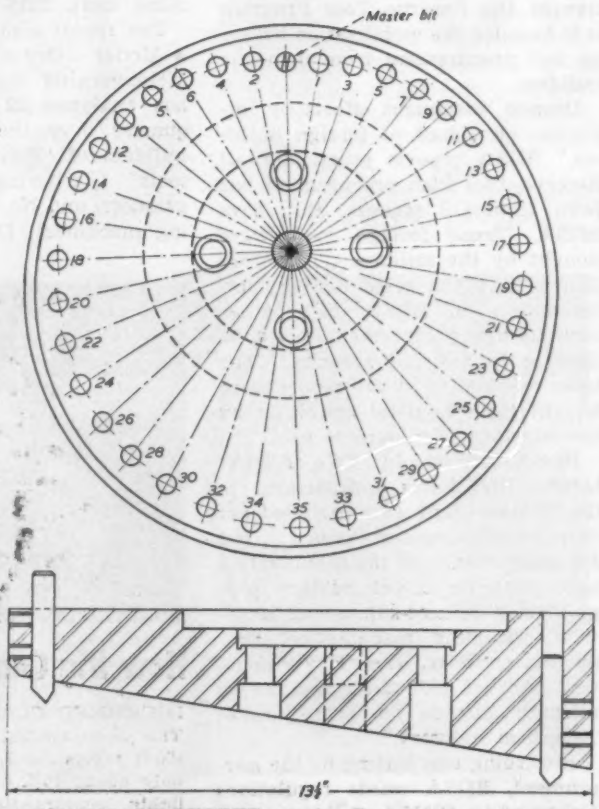
Odd Step Cutter Turns Planer-Miller Into Broach

COVENTRY, ENGLAND—A standard planer-type miller has stepped into a new role here as a rotary broaching machine for finish machining cylinder heads for Britain's Meteor tank engine at Jaguar Cars Ltd's plant.

The heads are so designed that joint and rocker cover faces are not parallel, one end of the head being 2 in. deeper than the other. To avoid difficulties in the design of fixtures, and to simplify clamping problems, lugs are cast near one end of the rocker bracket face to provide locations parallel with the joint face. In the final operation, these lugs must be machined off and the face fine milled.

As reported by W A Hawkins, associate editor of *Metalworking Production*, British McGraw-Hill's counterpart of *American Machinist*, the job is being done by an unusual progressive milling cutter on a Kendall & Gent planer-type milling machine. The tool is, in effect, a rotary broach which permits removing the lugs and finish-milling the face in a single pass. As shown, the body of the cutter is eccentric to the spindle of the machine, and the bottom face is at an angle to the horizontal to accommodate the inserted toolbits which are set at a varying radial distance from the center of rotation and at a varying depth from the top face of the cutter body.

As may be seen from the numbering on the drawing and the corresponding figures in the chart, bits on opposite sides of the cutter are treated as pairs. However, each bit in the pair is set at a different radial distance from the center and at a different depth. This splits the cut and causes the toolbits to cut progressively in two planes. The cutter is designed to run left-handed and operates at a speed of 840 rpm. Rate of feed is 8¼ ipm. The operation is performed as routine production and presents no special difficulties.



TOOLBITS IN CUTTER are, in effect, set in a pitch circle eccentric to the center of spindle rotation and staggered in relation to one another. Depth at which bits are set varies from one side of cutter to the other so tool cuts progressively in two planes

HEAVY PRESS FORGINGS:

They're Achieving New Lows in Machining Costs, SAE Told

LOS ANGELES — "We are now beginning to see a much brighter future in the reduction of machining costs through further development of conventional forgings," Wyman-Gordon's engineering - development VP George W Motherwell told SAE's Aircraft Production Forum here October 11-12.

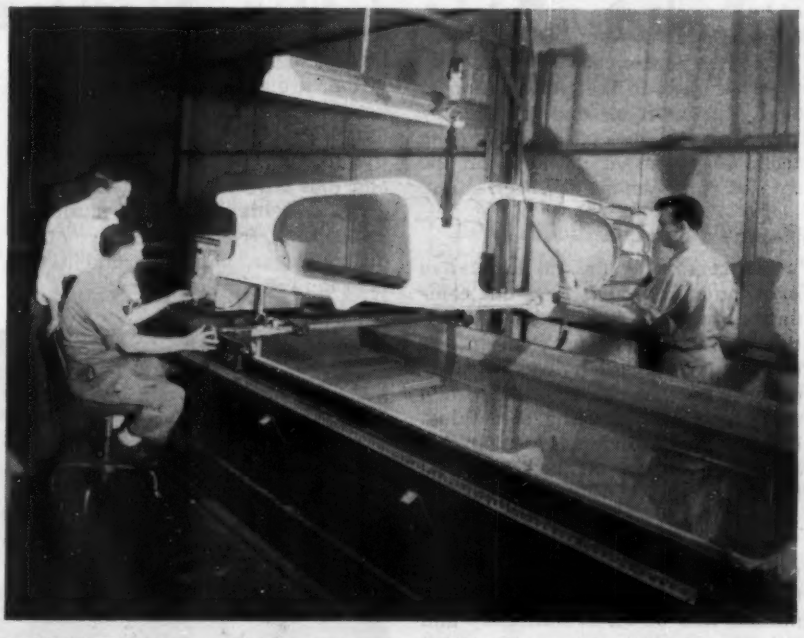
With the new Air Force heavy presses, such as the 35,000-tonner now in operation at Wyman-Gordon, "forging geometry is being refined," according to Mr Motherwell, who says Wyman-Gordon can produce draft angles as low as 3° on almost all designs, hopes to do even better. Aircraft wheels, he said, are being forged with draft angles as low as 1°, and this is being extended to airframe members.

Improved die steels and better lubrication methods are being investigated as aids in reducing web thicknesses, as is die quenching to reduce distortion during machining, Mr Motherwell said.

Reporting on progress of factors that control output of close-tolerance forgings, he said Wyman-Gordon has found that:

- Cr-Ni-Mo die steel is still the best die material. At 800 F it has a 150,000 psi yield strength, with a brinell of about 375, but die life is still short and very high pressures are needed to forge thin webs.
- New castable alloy dies such as aluminum bronze and beryllium copper show some promise, as do such methods as casting dies under pressure, and ceramic coating of wooden and plastic hobs. But present dies made from the new alloys aren't suited for long runs and have to be segmented if the die weighs more than 1000 lb.
- Knockout pins are being used to advantage where the part tends to stick, as in extruded forgings.
- Die heating methods have been advanced to the point where it is possible to hold constant temperatures for better die closure.
- A lubricant with a higher flash point and a minimum of smoke is still needed.
- It is possible that quenching fixtures can be developed that will give the same results obtainable with die quenching.

HEAVY-PRESS-FORGED WING SPAR, formerly blocker-forged, weighs 262 lb, is forged to die closure tolerance of +0.06 -0.00 in heavy press



176-LB FUSELAGE FRAME, produced in 35,000-ton press, has low draft angles and thin webs that eliminate hours of costly machining

RIBS OF THIS WING SPAR ROOT RIB have 1° draft. Closer tolerances completely eliminate cavity milling of pockets

CONGRESS PROBES AUTOMATION: The Experts Come

WASHINGTON — Congressional investigators are taking their first long serious look at automation—an issue that has lately been agitating industry, labor, and politicians.

The Joint Congressional Subcommittee on Economic Stabilization, headed by Rep Wright Patman (D, Texas) is holding extended hearings on automation's broad-gage "economic and social implications," and is taking testimony from a score of business, union, and academic experts. Metalworking industry people figure prominently in the roster of businessmen who appeared.

Up to now, the general impression left by the few expert witnesses who have testified is that automation is really just more of what this country has seen in the past — advancing technology — that its effect on the rate of employment has been slight.

No Laws Planned

The committee has no legislative plans on automation. Says one committee source: "If we had a substantial unemployment problem in the US, and automation was already putting people out of work, then we'd think about doing something. But we have full employment in this country and some people foresee labor shortages over the next 10 years."

D J Davis, Ford Motor Co's vice president for manufacturing, told the committee: "The growth of automation will be an evolutionary and not a revolutionary process, it should cause no more than a gradual shift of employment—a shift comparable to that from backward industries into new and growing industries . . . the most significant feature . . . will be from menial labor to higher skilled, better paid, safer and more interesting jobs."

Ford's Experience

Davis outlined Ford's experience with automation, said it meant taking "full advantage of the progress made by the machine tool and equipment industries."

The committee led off with John Diebold, New York management consultant on automation, who said the key to automation's economic impact is the rate of speed at which automation occurs. If the change takes place overnight, there should be much concern. But this won't happen, Diebold said.

He added that much talk about automation has been "confused and contradictory," that it has become an "issue . . . discussed with less regard for the facts than for the particular preoccupation of the speaker."

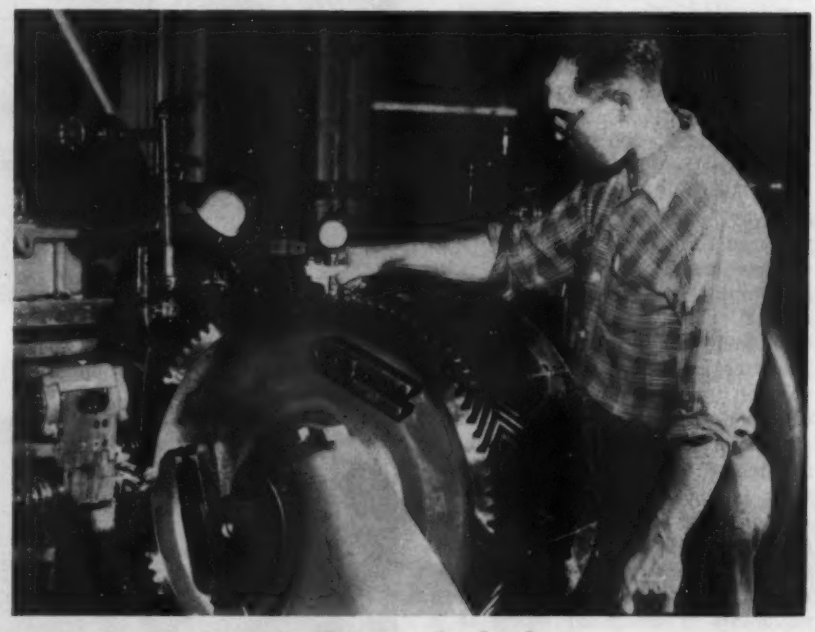
Walter S Buckingham, Jr, associate professor of Industrial Management at Georgia Institute of Technology, said: "Although automation rides the wave of the future, it is understandable why workers and consumers should be concerned. Our leaders of industry, who are men of vision, are also men of wealth and position who can afford to take the long run view. But the rest of us live in the short run, unfortunately, and that is where the potential dangers lie. A high degree of public responsibility from the leaders of industry, labor, and government will be required if the mistakes of the first industrial revolution are to be avoided." Automation has its greatest impact on labor, Buckingham said.

"No Mass Layoffs"

He conceded, however, that "there have been no mass layoffs" from automation, and that there is no long-run threat of resulting mass unemployment. Said the professor: "This is apparently because automation has proceeded slowly enough so far to allow normal turnover to disguise the displacement. The worker displaced is not fired. He is the one who is not hired."

Census Director Testifies

Robert W Burgess, Director of the Bureau of the Census, said employment statistics show that "while advances in science and technology may cause declines in some areas of employment, over the long term they create greater increases in others."



Drive Gears from Roll-Forged Blanks . . .

are cut on Sykes machines at Link-Belt Co's Philadelphia plant. Gears such as the 32-in. OD, 7½-in. face herringbone one shown being checked for tooth pitch can take a momentary overload of 100%. Link-Belt uses roll-forged steel blanks made by Baldwin-Lima-Hamilton that range in diameter from 18 to 32½ in., with face widths from 4 to 7½ in., weighing from 175 to 900 lb. Link-Belt, which machines gears for single, double and triple reduction units from the blanks says the forged blanks have a more uniform internal structure, and closer dimensional tolerances

to Its Defense Against "Mass Unemployment" Charges

Burgess said that in spite of the installation of improved machinery more workers are needed to produce the amount of goods and services wanted. During 1940-50, a period of rapid technological advances, the number of employed persons rose 25%, he pointed out.

He presented these figures: in 1899, some 4.5-million production workers were employed in manufacturing industries; in 1953, three times that number were employed although total population only doubled. Employment in machinery manufacturing industries rose from 400,000 in 1899 to five times that number in 1953.

Said Burgess: "Increases in professional services, in machinery manufacturing, and in repair services can fairly be ascribed, at least partially, to an increase in the demand for persons to design, manufacture and repair automatic equipment for applications in many different types of activities . . . I do not expect further development of machines to reduce the number of jobs over the long term."

. . . and here's what Ford—its first and major proponent—has to say in defense of the "Second Industrial Revolution" . . .

First testimony the committee heard from the industry most identified with automatic mass production was that of Ford vp D J Davis, who harked back to the fact that the auto industry really became an economic factor in the country with the application of automation — i.e., Henry Ford's revolutionary mechanized assembly lines.

Davis spelled out some of the factors that govern Ford's use of automatic machinery and processes today. Automation is no cure-all or universal answer to cost-cutting or other production problems, he said, even in auto manufacture.

"For example, we can economically justify the application of automation to the manufacture of engine components for the Ford engine," Davis said. But the same degree of automation "cannot be justified on the tractor and Lincoln engine components" because they are not produced in sufficient volume.

Automation can't be extensively applied in Ford's car assembly plants, Davis declared, because "we assemble in 20 different locations and are faced with technical problems and yearly changes in product design." Assembly accounts for some 30% of Ford employment.

Before extensively automatic production lines are created, a company has to weigh a great many factors, he noted:

- Will the new machines and equipment produce acceptable parts without excessive downtime and maintenance work?
- Can the machines be adapted, or realigned without excessive cost to take care of changes in design of the part?
- Considering the high cost of automatic processes—including the cost of engineering planning — will the increased depreciation charges nullify the saving in unit costs—or will the savings not be sufficient to offset the risk of installing the new equipment?

Davis then gave the committee some precise figures on the effects of automation on employment and other factors affecting employee relationships:

Ford and Mercury production of 1950 was 1,933,661 engines built in two plants near Detroit. The 1954 production was about the same (1,954,049 units from new engine plants at Cleveland and Dearborn).

Monthly employment on engine work in 1950 averaged 8253 direct labor employees compared with 6399 employees in 1954. This reduction of 1854 workers in direct labor, however, was offset by employment of 976 additional skilled maintenance personnel working on engine manufacture—and, as of September 15, there were no senior employees laid off from the two engine plants.

The number of skilled, higher paying jobs has increased, Davis said—and jobs have become vastly safer. For instance, the 1954 accident rate on engine-block machining was 60% less than in 1950.

Davis admitted that the company "cannot trace in precise detail the extent to which and the manner in which automation and other measures to improve efficiency have affected our over-all employment figures." However, Ford's non-defense employment in 1954 was 14% larger than in 1950.

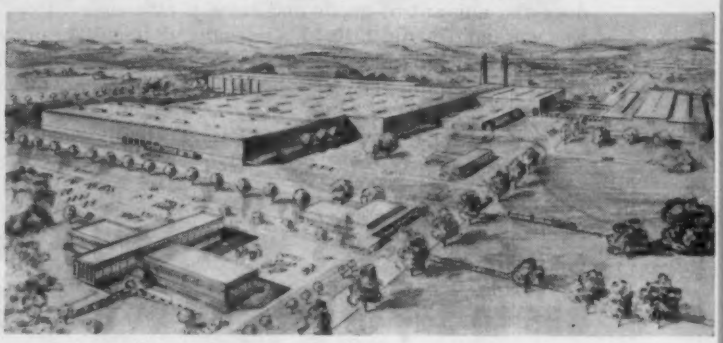
Davis also sketched what mass production via the auto industry has done for employment and living standards in general:

Back in 1908, it took a man 8 hrs to shape the upper half of a fuel tank, a process that today takes about 20 seconds; under the old methods, the part would cost about $15. Today it costs only a few cents. Applying the same relationships to the complete car, the price of an $1800 model would be about $50,000.

Statistically, Davis laid down what cost-cutting and mass production of autos has meant: besides its own employment, the industry is responsible for 90% of the employment in gasoline production, 80% of the rubber industry, 70% of plate glass, and 60% of alloy steel . . . "along with substantial percentages in other industries."

"The growth of automation will be an evolutionary and not a revolutionary process. It should cause no more than a gradual shift of employment . . . from menial labor to higher skilled, better paid . . . interesting jobs."

Chrysler's huge new stamping plant . . . midway between Cleveland and Akron will house 28 press lines—260 presses in all—with the biggest 1800-tonners. It'll cover 1.5-million sq ft, will employ 3500



Kaiser Aluminum's new rolling mill . . . now under construction at Ravenswood, W Va, will get $75 million more to enlarge initial integrated sheet and foil rolling mill facilities. It'll be ready early in 1957, will have an annual output of 333.5-million lb of sheet and foil

Companies in the News . . .

Crompton & Knowles Loom Works, Worcester, Mass, has acquired **Wrap-King Corp,** Holyoke, Mass, manufacturers of packaging machinery, and **Carl N Beetle Plastics Corp,** Fall River, Mass.

Piasecki Helicopter Corp is thinking of changing its name to **Vertiplane Corp.** Reason: founder Frank Piasecki quit in a huff this summer, formed a new firm, **Piasecki Aircraft Corp.**

Leopold D Silberstein, who took over **Niles-Bement-Pond** earlier this year, has merged it into his **Penn-Texas Corp,** changing the N-B-P name to **Pratt & Whitney Co Inc** (no relation to United Aircraft's Pratt & Whitney Aircraft Division). Mr. Silberstein's rumored next acquisition: the famous old New England firearms makers, **Colt's Manufacturing Co.**

Pioneer Engineering & Mfg Co Inc has formed a new body engineering division, will set it up in Pioneer's 40,000-sq-ft Goldner Division plant.

Chrysler Corp's huge new automatic transmission plant at Kokomo, Ind, is 90% completed. More than 150 machine tools are already in place, with 300 more coming in. Another 500 are being built in machine tool builders' plants.

Eaton Mfg Co will spend $1.25 million to expand its hydraulic pump manufacturing facilities at Marshall, Mich. Floor space will be enlarged 19%; balance of the money will go for equipment.

Republic Steel has expanded its stainless steel cold rolling and finishing facilities at Massillon, Ohio, increasing sheet and strip output by 25,000 tons a year.

Gear Grinding Machine Co's new addition to its Detroit plant has increased screw machine and grinding machine manufacturing floor space by one-third.

Detroit Reamer & Tool Co this month moved into a new plant and offices at 780 West Maple Rd, Birmingham, Mich.

Pacific Industrial Mfg Co, Oakland, Calif, will set up a hydraulic press and equipment manufacturing plant at Mt Carmel, Ill.

Hamilton Mfg Co, New Haven, Conn, has purchased the **Barnaby Tools** Division of **Barnaby Mfg Co,** Bridgeport, Conn, makers of screw machine and turret lathe tools. Hamilton will manufacture the Barnaby line of workholding devices, gages, and knurling tools at its New Haven plant.

New Britain Machine Tool Co, New Britain, Conn, has purchased the **Hand Tool Division of Blackhawk Mfg Co, Milwaukee,** where it will continue the manufacture of hand tools. New Britain has also acquired a one-story plant, into which it will consolidate all operations of its Dayton, Ohio, subsidiary, **Koehler Aircraft Products Co.** Koehler operations were formerly spread out over three plants.

Dana Corp's Parish Pressed Steel Division has a multi-million-dollar expansion program in the works that will increase its auto chassis frame output 40%. Two additions will be made to the present Reading, Pa, plant, increasing overall plant space to 873,000 sq ft.

Automatic Molding Machine Co has opened a plant at 3217 Exposition Place, Los Angeles, to manufacture automatic molding machines.

Timken Roller Bearing Co will spend $7 million on new capital goods and expanded manufacturing facilities for its Steel and Tube, Rock Bit and Bearing Divisions. Included will be purchase of automatic screw machines and grinding equipment for all divisions.

Plomb Tool Co, Los Angeles, has purchased **Tubing Appliance Co,** makers of open-end rachet wrenches for industrial machinery.

Bendix Aviation Corp will spend $2 million expanding its Scintilla Division, Sidney, NY.

PRATT & WHITNEY CO INC APPOINTS: Albert L Knapp (left), formerly superintendent of the Machine Tool Division, to be a vice president and manager of the Machine Tool Division; Jacob J Jaeger (center), formerly chief engineer of the Machinery Division, to be a vice president and chief engineer of the Machine Tool Division; and Edward J Ferris (right), formerly assistant general superintendent of the Machine Tool Division, to succeed Mr Knapp as general superintendent of that division

Names in the News . . .

Lamber G Neff Sr has been elected board chairman of Simplex Machine Tool Corp, Milwaukee; **L. J. Radermacher,** president; **Vernon A Forsberg,** secretary-treasurer.

Lloyd E Schumacher, sales manager, and **Daniel T Gunderson,** chief engineer, have been appointed vice presidents of J B Rea Co, Santa Monica, Calif.

Puget Sound Sheet Metal Works, Seattle, elections: **Harry S Bowen,** chairman of the board; **Gordon B Anderson,** president; **George T Dexter** executive vice president; and **George K Taylor,** vice president for production.

Thomas P Wall, former manager of Peacock Brothers Ltd, Toronto, has been appointed general manager of Rockwell Manufacturing Co of Canada Ltd, Guelph, Ontario.

Norman E Seymour, formerly works manager of Borg-Warner's Wooster, Ohio, Division, has been named works manager of the steel fabricating and oil filtering divisions of Michiana Products Corp, Michigan City, Ind.

William L Clark, chief metallurgical and test engineer of Alco Products Inc, Schenectady, has been appointed product manager of the company's Alcoplate process.

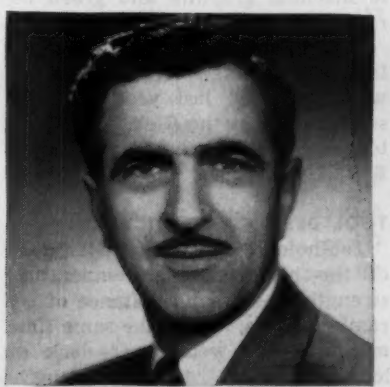
Precision Casting Co of Harrisburg Steel Corp, elections: **E H Heckett,** chairman of the board, director; **William J During,** president, director; **J J Punke,** senior vice president, director; **A G Lintel,** vice president, director; **Ross W Castle,** vice president, director; **A D Weigolt,** vice president, Cleveland plant; **E A Dunning,** vice president, Cortland plant; **Stanley Frost,** vice president, Kalamazoo plant; and **A G Chase,** honorary chairman.

Philip C Wood, chief engineer of Acklin Stamping Co, Toledo, has been named factory manager. **Egon F Hirschmann,** assistant to the vice president, has been appointed director of production and personnel.

James L Woodley has been made manager of the Danville, Ill, plant of Hyster Manufacturing Co.

GEORGE BENNETT has been elected president of Borroughs Mfg Co, Kalamazoo, Mich, subsidiary of American Metal Products Co. He was formerly general manager of the company

H F DEVENS has been named sales manager for Olin-Mathieson Chemical Corp's Roll Bond process. He was previously assistant to the general manager of the Metals Division



ALLEN W SALZMAN of Racine Hydraulics and Machinery Inc has joined Waukesha Tool Co, Waukesha, Wis, as chief engineer, and will head Waukesha's new Thrust Bearing Division

New Shop Equipment

Ceramic toolbit and holder above must be rigid with even distribution of clamping forces. Turning test at left is on SAE 4140 at 1500 fpm, with 0.010-ipr feed, ¼-in. depth of cut

Norton Ceramic Toolbits Available in Limited Quantity

Two grades of ceramic toolbits developed by Norton are now offered in limited quantities, primarily for research and machining studies. One is a straight cemented aluminum-oxide toolbit, white in color, and the other contains aluminum oxide and a small percentage of other ingredients that result in a black toolbit. Designations are LA162 and LA603.

Norton started a development program on ceramic tools in 1935 at the Chippewa, Canada, laboratories. The early program was not successful, but later developments of strong polymerizing cements and improvements in mechanical holders led to ceramic tools that are regularly used to machine graphite and green ceramics.

Investigation of ceramic toolbits for metal cutting started in 1945 and was intensified last year with the start of tests at the Rodman Laboratory of Watertown Arsenal (*AM*—Feb 28, '55, p153).

TOOL DESIGN IS CRITICAL

Toolholders must take advantage of the hardness, high-temperature strength, and wear resistance of ceramic toolbits, and at the same time minimize the weaknesses—lack of low-temperature tensile strength, ductility, and thermal shock resistance.

Toolholders require substantial cross section providing maximum support for the bit. In the tool illustrated, the ceramic rests on a carbide shim and is held by a top clamp that distributes the forces evenly. A mechanical carbide chip breaker is brazed to this clamp.

In an alternate holder now under development, a carbide shim is also placed behind the side of the bit. Adjusting screws permit this shim to be advanced as needed.

Tool angles are also critical. The present design has a side cutting edge angle of 10°, end cutting edge angle of 5°, and no back rake. However, a 7° negative land about 0.025 in. wide is honed on the cutting edge. This land seems to be essential for good tool life. Front and side clearance are both 10°. Nose radius should be at least 1/16 in.

Tools are ground dry with metal-bonded diamond cup wheels, 150 grit for forming or roughing, 320 grit for finishing. The 7° negative land is applied with a vitrified-bond diamond hand hone.

OPERATING EXPERIENCE

Cutting speeds up to 1800 fpm have been used without damage to the tool, and higher speeds are believed feasible when machines with sufficient power are available.

In the turning operation illustrated on SAE 4140 steel, the maximum rate of metal removal was achieved with a speed of 1500 fpm, a feed of 0.010 ipr, and a depth of cut of ¼ in. Some test results from Rodman are shown in the table.

SIGNIFICANCE

One of the most important factors leading to development of the ceramic tools is the abundant supply of the aluminum oxide and other ceramic materials and the prospect of saving tungsten and cobalt. The sup-

MACHINING TESTS (DRY) WITH CERAMIC CUTTING TOOLS

Material	Speed, fpm	Feed, ipr	Depth of Cut, in.	Tool Travel Before Regrind, in.
Brass	650	0.010	0.125	88
Cast Iron	300	0.010	0.125	70
SAE 4140	350	0.010	0.125	76
SAE 4140	250	0.008	0.125	184
SAE 4140	600	0.008	0.160	102
SAE 4140	950	0.008	0.125	106
SAE 4140*	910	0.012	0.250	86
SAE 4140	1200	0.012	0.125	120

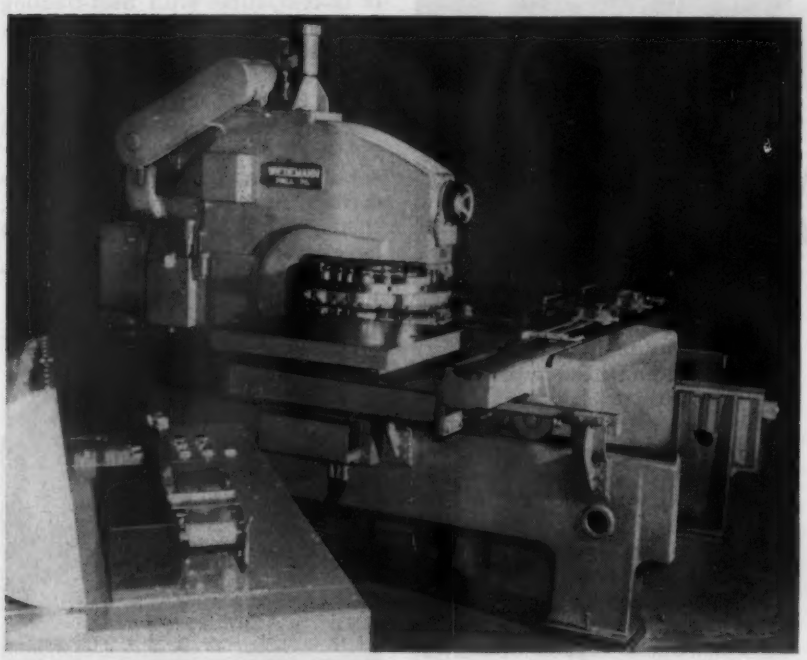
*Heat treated to 300 Bhn

Materials and Parts . . .

ply situation opens the possibility that ceramic toolbits may in time be less expensive than carbides.

Norton reports that the new tools do not pick up heat, have less friction loss, and are more resistant to cratering than conventional tools. In some cases, maximum speeds and feeds have produced molten chips without damage to the tool. In cuts on cast iron with sand holes, the ceramic tools are said to cut through without chattering or breaking down.

Norton Co, Worcester 6, Mass



Tape-Controlled Turret Punch Press

Automatic turret punch press has a capacity of 40 tons, and throat depth of 33 in.

Press and work-locating table are controlled by tape-fed electromechanical programming unit which performs all functions, including positioning work under the punch, selecting the turret station carrying the punch and die, and tripping the press. Cycle is repeated until all holes are finished.

Setup consists of placing desired tape in programmer and loading material onto the table. Material is positioned by operator to mechanical zeroing stops and clamped in position.

Vinyl tape is oil- and grease-resistant. Complete job is punched on tape, which can then be filed and used for subsequent repeats of the order. Engineering changes in the tape can be made by covering the old section of the tape with a gummed sticker, and punching the new information. Also, any section of the tape can be removed, replaced, or covered.

Programming unit and controls are electro-mechanical. "Building block" units are used, installed on sliding, pull-out trays, designed for easier maintenance.

Turret is said to hold all punches normally needed for a particular job. Up to 20 punches can be held, with each punch size up to 6 in. square. Punches are said to be replaceable in 1½ to 2 minutes.

Any Wiedemann turret punch press with direct-measuring table can be supplied with this automatic programming unit.

Wiedemann Machine Co, 4272 Wissahickon Ave, Philadelphia 32, Penna

. . . including

MACHINE TOOLS AND ATTACHMENTS

Dial-type milling machine....page 183
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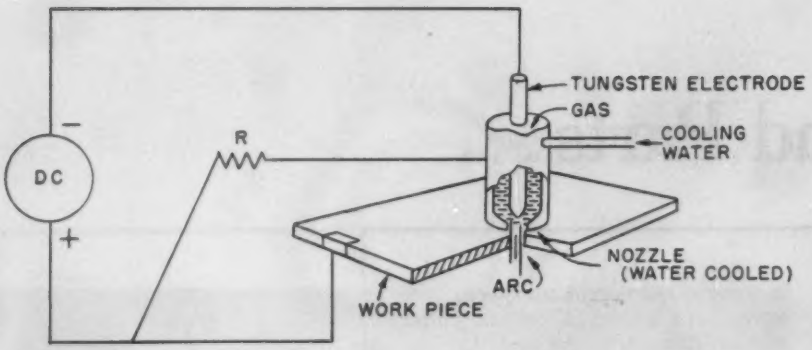
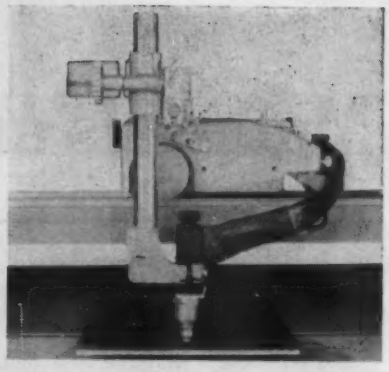




Gas-Shielded Arc Cuts ¼-in. Aluminum At 300 ipm

Heliarc cutting, utilizing familiar gas-shielding principles and equipment based on that for welding, will cut aluminum at high speeds, and offers promise on other non-ferrous metals and even on steel. A high-temperature, high-velocity constricted arc between a tungsten electrode and the piece to be cut generates confined, straight-line energy which melts and ejects a thin line of metal to form a kerf 3/16 in. wide at the top and ⅛ in. at the bottom.

Any contour can be followed and a square-cornered, smooth, flashless edge is produced.

Normal mechanized cutting speeds for aluminum are: 300 ipm in ¼-in. plate; 125 ipm in ½-in. workpiece; 75 ipm in ¾-in. metal; and 50 ipm in one-in. material. Average cutting speed by hand is about 60 ipm in ½-in. aluminum. No pre-cleaning before cutting or post-cleaning before welding is necessary. The cut is without oxides or slag because of the inert-gas envelope.

A standard high-frequency starting unit, in conjunction with the pilot circuit, initiates mechanized cutting. In manual operation, a pilot arc in an argon atmosphere starts the cutting arc. Light from the pilot arc in argon helps the operator locate the desired piercing point when his helmet is in position. The cutting arc can pierce the workpiece at any point.

Optimum gas mixture for machine cutting is 65% argon and 35% hydrogen. The high arc voltage necessary for the mixture is obtained from a power supply with an open-circuit voltage of 100 volts. For manual cutting the gas consists of 80% argon and 20% hydrogen. This lower hydrogen content provides greater tolerance for arc length yet gives maximum cutting speeds without loss of quality. In fact, loss of the cutting arc usually results from failure to move the torch fast enough because the cutting arc is dependent on new metal under the electrode.

Manual cutting requires a HW-12 manual welding head with a new collet and collet body and a new nozzle with O-ring construction, usually of hard copper. A control panel, starting unit, electrical contactor, high-open-circuit voltage mg set, shielding gas supply and water supply are also necessary. The mechanized unit requires a travel mechanism which can be a geared-up CM 45 carriage for straight cutting, or any other device capable of delivering required speeds.

Typical operating conditions for machine cutting are:

Thickness, in.	Speed, ipm	Amps	Volts	Gas, cfh
¼	300	320	70	50
½	125	320	75	60
¾	75	320	77	70
1	50	320	80	70

Linde Air Products Co, Div of Union Carbide and Carbon Corp, 30 E 42nd St, New York 17, NY

Shell Quenching Oil

Shell Voluta Oil 23 makes low carbon or low alloy steel quenching possible with high initial cooling rate which avoids unwanted transformation products. Slow final stages of cooling control warpage, cracking, or distortion, and the high heat removal rate makes step-quenching unnecessary.

Other advantages claimed for this product are its high water tolerance, low volatility and drag-out losses. It is compatible with heat-treating salts, and does not bake onto hardened parts.

Voluta 23 has a flashpoint of 380 F, fire point 425 F, pour point 25 F, viscosity 121.9 Sus at 100 F or 41.5 Sus at 210 F. SpG is 29.9° API.

Hand tools, punches and dies; wire springs; milling machine tools; shafts, axles, and connecting rods have been hardened with this oil.

Shell Oil Co, 50 W 50th St, NY 20, NY

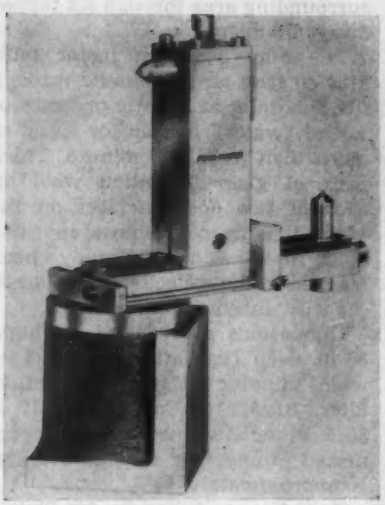
Carborundum B7 Cutoff Wheels

"Aloxite" aluminum oxide resinoid-bond cutoff wheels are said to provide cooler action because of special bond which produces sharp sides on all wheels, to prevent binding in the cut.

Three grades are available—"R" for minimum burning; "T" for general purpose work; and "V" for rough work where maximum wheel life is most important factor.

Wheel sizes range from 6 to 20 in. in diameter, 1/16, 3/32, and 1/8 in. thick. Metal bushings are supplied on all arbor holes in ranges of 5/8 to 1 3/8 in. All wheels are available in 24 to 120 grit.

Bonded Abrasives Div, The Carborundum Co, Niagara Falls, NY

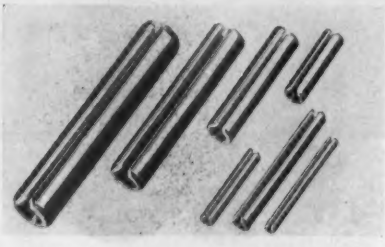


Heavy-Duty Dresser For Larger Radii

New model Form Master Wheel dresser for close precision work can take up to an 8-in. convex radii and up to a 12-in. concave radii on an 8-in. wheel.

Unit dresses with the diamond point horizontal to the center of grinder spindle. It is equipped with sealed ball bearings and hardened and ground parts. Drilling and tapping of holes are possible in the cast iron base when needed for setup.

J & S Tool Co, 87 Dorsa Ave, Livingston, NJ



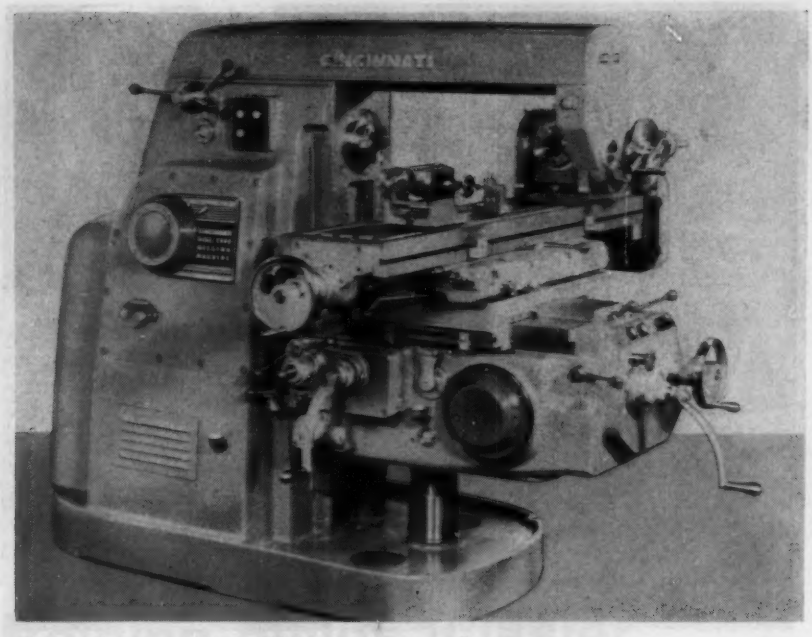
Beryllium-Copper Rollpin Has Non-Magnetic Qualities

"Rollpin" line extends use of device to non-magnetic applications, requiring good electrical conductivity and corrosion resistance. Product is said to be useful for plumbing fixtures, electrical instruments, outboard motors, and chemical equipment.

Like the steel "Rollpin", the device has slotted, chamfered tubular spring pin, heat treated for strength. Pin has diameter slightly larger than fractional-drill-size hole into which it is to be inserted. Insertion thus gives pressure against hole walls, preventing loosening during vibration.

Sizes from 0.062 to 0.250 in. in diameter, in wide range of lengths.

Elastic Stop Nut Corp of America, Union, NJ



Cincinnati Milling Machines Have Synchro-Mesh Spindles

Cincinnati dial-type milling machines are more powerful than former design, with pushbutton control, and wider range of speeds and feeds. Machines are built in No. 2, 3, and 4 sizes, with plain, universal, and vertical styles for each size. Spindle speeds range from 18 to 1800 rpm for No. 2 machine, and 16 to 1600 rpm for No. 3 and 4 sizes. Speeds are indicated by a dial on the left-hand side of the column, and selected by 2 pushbuttons, "increase," and "decrease" at the "console" speed change, front of the knee, or at the left-hand side of the column. Pushbuttons start and stop the spindle drive, and start and stop the coolant pump. No. 50 standard spindle nose has been retained.

With a synchro-mesh principle in the spindle drive, when the motor is running, the gear train constantly rotates at a very slow rate, to ease shifting gears and cut gear clashing during shifting. Spindle drive clutch and brake are hydraulically operated, and require no adjustment.

The 32 feeds, ⅜ to 90 ipm, are selected with a knob; one is at the front and one at the rear of the operating stations. A feed-indicating dial is located beside the knee.

Power rapid traverse is at 150 ipm. Feeds and rapid traverse are powered by an independent 3-hp motor mounted on the knee. The feed box is self-contained, mounted in the knee.

Cutting fluid pump is individually motor-driven.

Plain and vertical machines can be equipped with automatic table cycles. When equipped with this device, the machine is provided with a single four-position lever for manual table control. Automatic-cycle machines may be tooled up with one fixture, for one-way single cycles, or fixtures at both ends of the table, for two-way reciprocal milling, either continuous or with center stop.

Engagement of feeds at the higher rates is said to be quicker and surer because of a new type of spring clutch on the table feed screw.

Table handwheel has automatic knockout and an interlock arrangement in the rear hand-crank sockets for cross and vertical traverse, preventing these from being operated when the corresponding power feed is engaged.

Catalog No. M-1915.

The Cincinnati Milling Machine Co, Cincinati 9, Ohio

Totally Enclosed Fractional-hp Fan-Cooled Electric Motors

Century electric fractional-hp, totally enclosed, fan-cooled motors are built to conform to new NEMA frame sizes so that line now includes powers from ½ to 100 hp.

Motors have aluminum rotor with skewed laminations; fan integrally cast with rotor, acting as rotating seal; 6-layer insulation; mechanical modifications which provide for both P and C brackets (NEMA designations).

Century Electric Co, 1806 Pine St, St Louis, Mo

Norton Multi-Wheelslide Grinder Plunge-Grinds Several Diameters

Type CMS-1 semi-automatic, multi-wheelslide cylindrical grinding machine is designed to plunge-grind multiple diameters simultaneously on work which, because of its shape, does not lend itself to grinding on conventional grinding machines. The machine has unitized wheel slides which are positioned during manufacture for the requirements of a specific job. The wheelslides may be opposed or placed in line, whichever is better suited. Provision is made for slight lateral or angular adjustment of position for setup purposes. The slides are self-contained with respect to motion and truing, but operate in unison during production.

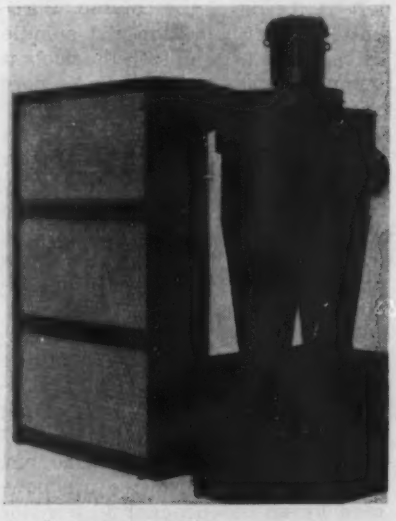
Operation of the machine is by centrally located one-lever control of the automatic grinding cycle and automatic termination of the cycle under electrically timed control. Auxiliary independent control of the wheelslides is provided for setting up.

Each wheelslide mounts one or more 30-in.-diameter grinding wheels, as the job dictates. The kind of work-holding equipment is also determined by the job, both chucking and between-centers arrangements being available.

Two-rate automatic feed is said to provide rapid stock removal, and good finish. Wheel-feed handwheels have "click-count" indexing mechanisms which permit feed adjustment in increments of "tenths" without visual attention. Jogging control of wheelslide movement is individually pushbutton-operated during regular operation. The increments of jogging control are adjustable.

Automatic wheel truing is by wheel-guard-type devices which operate at predetermined speed and feed. Compensation of wheelslide setting for the amount of wheel diameter reduction after truing occurs automatically.

Norton Co, Worcester 6, Mass



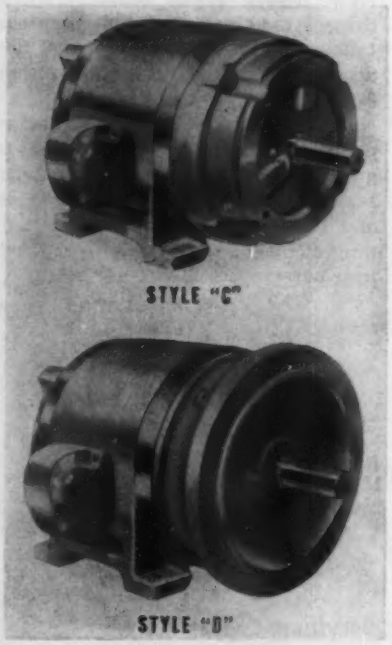
Cyclone Dust Collector Recirculates Filtered Air

Model 219 FM-A, for collection of dust, lint, chips, powders, and fumes, recirculates filtered air back into the surrounding area through six throw-away filters.

The 5-hp 3450-rpm motor pulls 2100 cu ft of air per minute through the 8-in. inlet at a static pressure of 3.0 in. (water) and an air speed of more than a mile a minute. Thick pads of glass insulation wool on each of two open surfaces on the after-filter frame remove any fine dust that has not already been trapped in the collector's 8-1/2-cu-ft-capacity internal reservoir.

Dimensions are: 93-1/4 in. high; 30 in. deep (less after-filter); 24 in. wide; shipping weight, 635 lb; after-filter, 81x51x14. Complete unit is $875. Filter alone, which can be connected to any new or used 219 FM, is approximately $350.

Torit Manufacturing Co, 287 Walnut St, St Paul 2, Minn



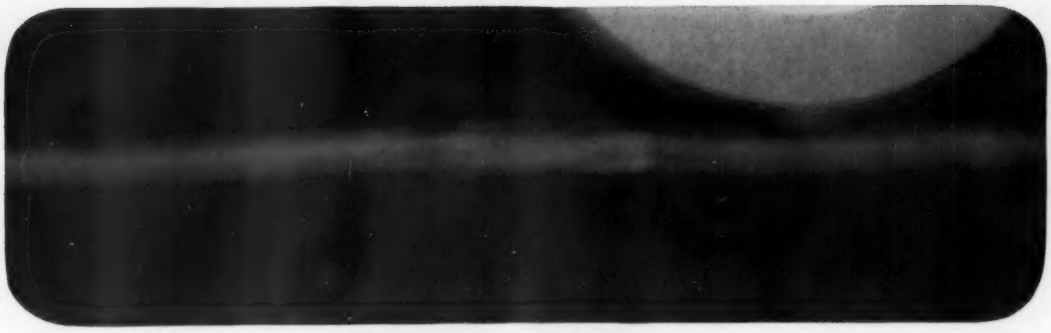
Uniclosed Electric Motors Built to NEMA Specifications

Horizontal motors with face-type mounting brackets for direct connection to driven equipment are built to rerated NEMA specifications, style C or D. Style C brackets take bolts from driven machine, while style D permits bolting from motor side. Available in ratings from 1 to 30 hp.

Ventrifoil deflectors direct air and deflect water. Windings are asbestos-protected. Split-type conduit box may be located on either side of the motor. Lubriflush lubrication of ball bearings is said to insure purging of old grease.

U S Electrical Motors, Inc, Box 2058, Los Angeles 54, Calif

Welding builds it faster, lighter and safer...



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It swims. It climbs. It fights. It's tough and strong. For, from stem to stern, this L. V. T. is welded.

Welding saves precious weight and countless man-hours in construction. It avoids the rivets and bolts which become as lethal as shell fragments under shock.

With Radiography checking for soundness, welding continually finds new work to do—solves problems that would make jobs like this L. V. T. virtually impossible.

So weld shops, with small operations or large, are finding radiography valuable both for building reputations for good work and for expanding into new fields. If you would like to explore how Radiography can help you increase your business, get in touch with your x-ray dealer. He'll gladly talk it over.

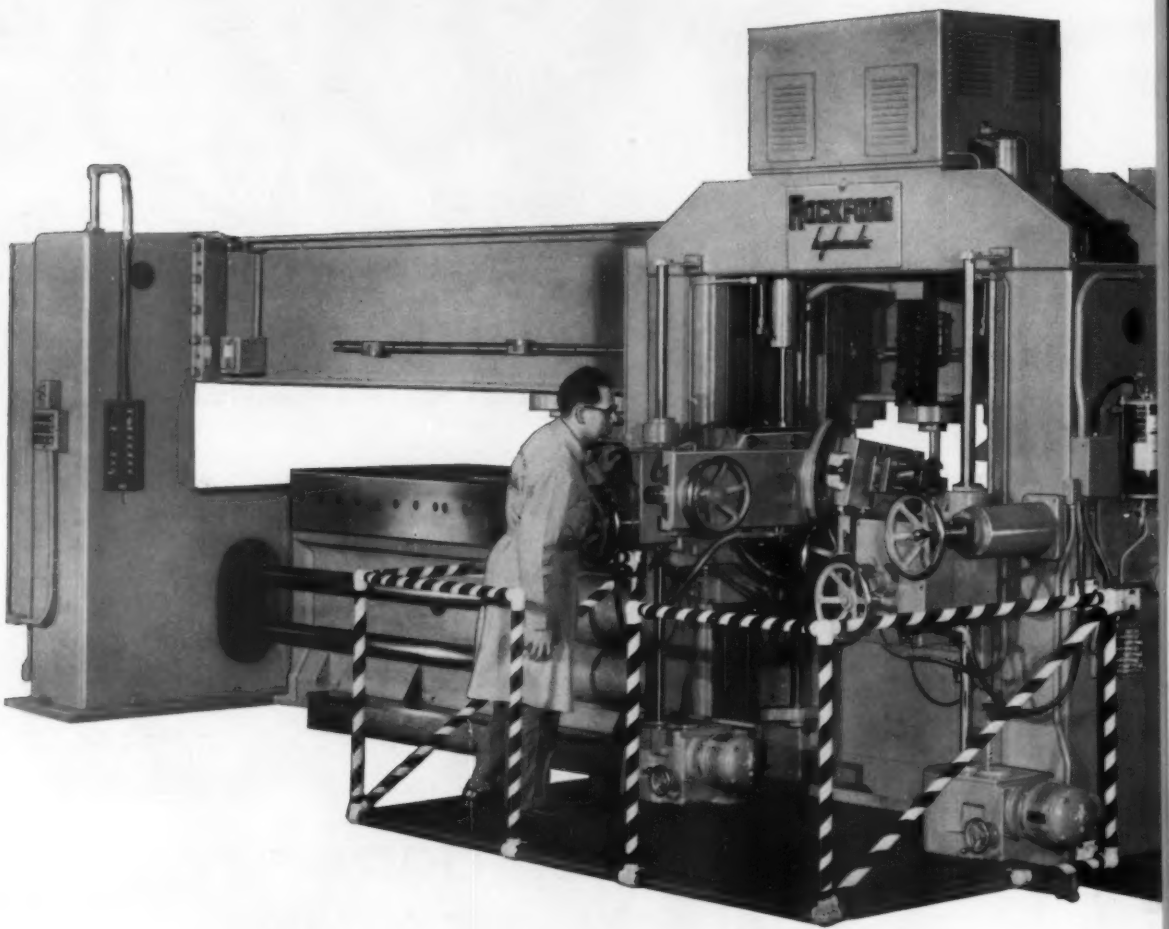
RADIOGRAPHY

... another important example of photography at work

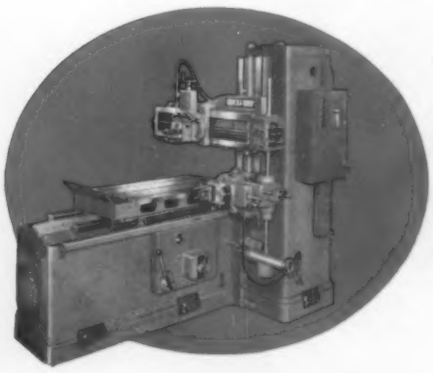
Kodak

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N.Y.

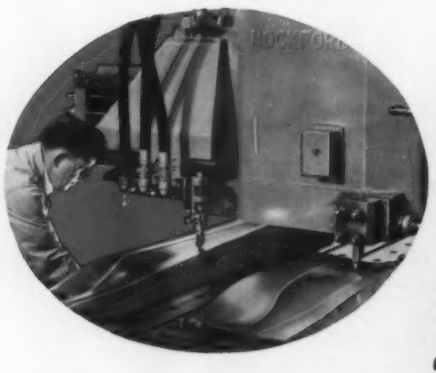
another new hydraulic design...



Hydraulic Openside Shaper



Hydraulic Kopy-Kat Duplicator



Hydraulic Shaper-Planer

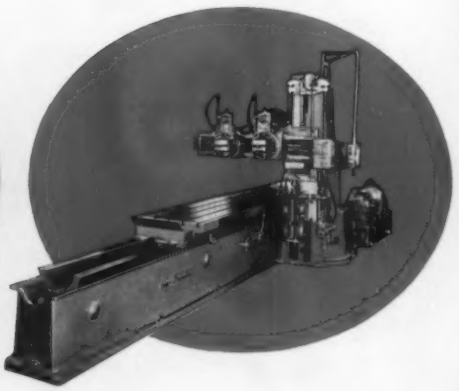


plate edge PLANER

with triple circuit!

....the new Plate Edge Planer is one of the latest developments of the Rockford Machine Tool Co.

....it represents the first basic improvement in this type of machine in the past half century.

....the Hydraulic Plate Edge Planer has a working capacity up to 30' wide x 7 inches thick and its saddle reciprocates from 10 to 200 feet per minute. It is also equipped with the company's extraordinary new Triple Circuit . . . which permits three speed ranges and three force ranges — all infinitely adjustable . . . and controlled from the pendant.

....ask a Rockford Machine Tool Co. representative for further details on this new machine — and how modern "Hydraulic" equipment cuts costs on every type of shaping, planing, slotting and duplicating.

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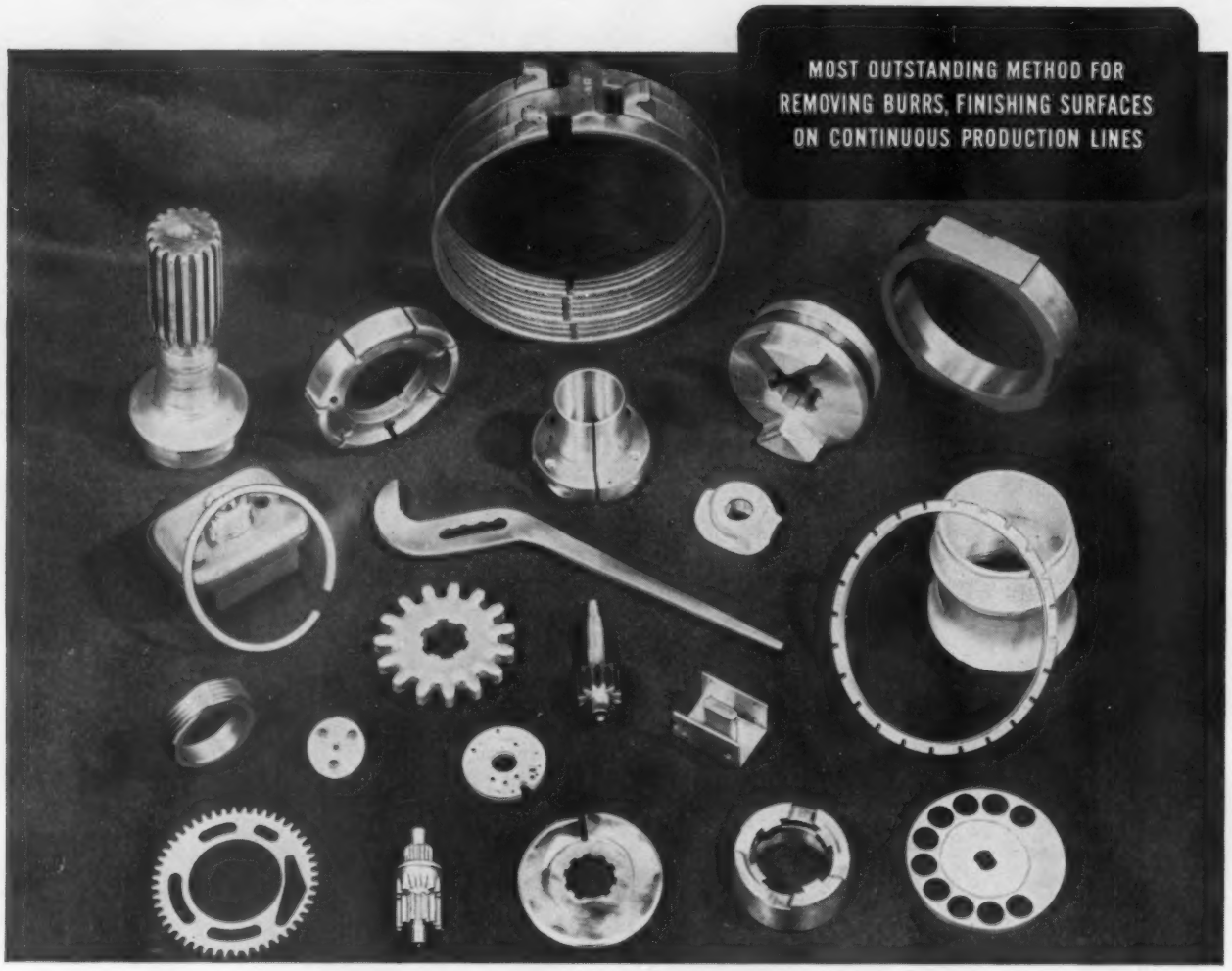
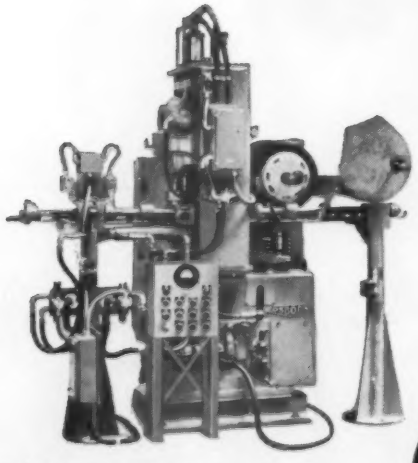
Hy-Draulic



BRUSHAMATION BY OSBORN



AUTOMATED BRUSHAMATIC®... One of Osborn's integrated production line automatic power brushing machines.

The parts shown above are typical of the work you can now handle with Osborn's line-production power brushing method... ***BRUSHAMATION.***

COMPLETELY INTEGRATED... Osborn's Automated Brushamatic® Equipment fits right into your production line.

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... all without manual handling.

Qualified engineers will show how you can benefit with automated brushing at the Osborn Booth 718, The Metal Show, Philadelphia, Oct. 17-21. If you can't make the show, write us for complete information. *The Osborn Manufacturing Company, Dept. C-38, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

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FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 GEAR GRINDING MACHINES—*Gear Grinding Machine Co, Detroit 11, Mich.* 8-page brochure describes line of fully automatic units. Features of different models illustrated, specifications provided.

2 RIGID SHAPERS — *Cincinnati Shaper Co, Cincinnati 25, Ohio.* 4-page illustrated folder outlines features of new units ranging in capacity from 16 to 36 in., with plain or universal tables. Includes dimensions, specifications, special equipment.

3 JIG BORING MACHINES—*Homestrand, Inc, Larchmont, NY.* 7-page illustrated data sheet contains detailed descriptions of Type SJ and SJB ASEA units, with information on available accessories.

4 VERTICAL MILLING MACHINE—*South Bend Lathe, South Bend 22, Ind.* 4-page illustrated folder covers new miller with 8 spindle speeds from 135 to 3750 or 90 to 2500 rpm. Advantages listed, specifications provided.

5 PRESS BRAKES—*Cincinnati Shaper Co, Cincinnati 25, Ohio.* 4-page illustrated folder contains general data and dimensional information on two new series: the 2-30, a 30-ton unit with 14-gage x 6-ft capacity, and the 3-50, a 50-ton machine with 10-gage x 6-ft.

6 POWER PRESSES — *Sales Service Machine Tool Co, St Paul 14, Minn.* 8-page illustrated bulletin 855 contains description of Press-Rite OB, inclinable line from 2 to 85-ton capacity, with specifications and general data.

7 THREAD ROLLING MACHINE—*Landis Machine Co, Waynesboro, Pa.* 16-page bulletin E-60 illustrates and describes the Lanhyrol unit; produces threads by 4 methods of rolling, as necessitated by workpiece design or material hardness. General features, design innovations, operational details, auxiliary equipment, specifications included.

8 INCLINABLE POWER PRESSES —*Johnson Machine & Press Corp, Elkhart, Ind.* 4-page bulletin 1956 gives illustrated information and specifications of 20 models of power presses, flywheel and back-geared type.

9 PUNCHED TAPE CONTROL SYSTEM—*Barnes Engineering Co, Stamford, Conn.* 8-page illustrated brochure describes application of Binotrol to a J&L turret lathe for complete automation. Detailed oprating principles; preparation of of tape, applications coded to lathe's function, advantages discussed.

10 GEAR SHAPING MACHINE—*Maschinenfabrik Lorenz A G Ettlingen/Baden, Germany.* 4-page illustrated brochure contains pertinent information on SRO high-speed, short-stroke gear shaping unit. Design features, technical data, dimensions included.

11 INDEX TABLES—*Ferguson Machine & Tool Co, St Louis 21, Mo.* 12-page catalog 300 illustrates and describes the Intermittor for horisontal or vertical use; from 12 to 48-in. dials; from 4 to 36 work stations; up to 500 indexes per minute. Contains selection data, dimensions, specifications, standard accessories.

12 METALWORKING MACHINE—*J F Kidder Mfg Co, Burlington, Vt.* 4-page circular contains information on "Little Blacksmith" No. 55 unit. Available attachments illustrated for punching, notching, bending, angle shears, etc. Throat depth, 6½ in.; weight with floor stand, 350 lb.

13 COMBINATION WAY & SURFACE GRINDERS — *Mattison Machine Work, Rockford, Ill.* 8-page illustrated booklet describes heavy unit for grinding of large bed castings, columns, tables, slides, saddles, and heads to precision tolerances. Independent vertical and horizontal spindles; 3-column box-type construction for maximum stock removal and fine finish; pendant control panel. Dimensions and specifications provided.

14 PRESSES—*Service Machine Co, Chicago 20, Ill.* 4-page illustrated catalog covers Rousselle line including deep-throat punch. OBI inclinable, and horn models. Units illustrated, specifications provided.

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15 CONTROLLED-AIR-POWER DEVICES—*Bellows Co, Akron, Ohio.* 8-page bulletin ML-3 describes complete line. Air motor and its interchangeable valves illustrated with various applications. Data provided on drillpress feeds, vises, hydrocheeks, rotary feed and index tables, and other Bellows packaged devices.

16 WAY-TYPE HYDRAULIC FEED UNITS—*Hartford Special Machinery Co, Hartford 12, Conn.* Illustrated data sheet outlines features and specifications of balanced-thrust units. Similar data sheet covers automatic cam-feed drill units designed for faster cycling, narrow construction, greater flexibility.

TOOLS AND ACCESSORIES

17 DIAL GAGES & SETMASTERS—*Boice Manufacturing Co, Staatsburg, NY.* 16-page illustrated bulletin 55 contains detailed information on line of snap, bore, large diameter and length gages and companion setmasters. Price list, ordering data, and ruled sketch sheets are included for presentation of gaging problems to the company.

18 HYDRAULIC VISE—*Columbian Vise & Mfg Co, Cleveland 4, Ohio.* Illustrated bulletin LL-2029 describes No. 1004, controlled by two foot-pedals. Unit has single, replaceable cartridge.

19 LUBRICANT—*Alpha Molykote Corp, Stamford, Conn.* 2-page bulletin 101 gives qualities and features of Molykote Type BR 2, a multi-purpose grease with extreme bearing pressure properties. Physical specifications, test data, prices and ordering information included.

20 TOOLING FOR MULTIPLE- SPINDLE MACHINES — *Scully-Jones & Co, Chicago 8, Ill.* 8-page illustrated bulletin 8-50 covers various applications for quick-lock adjustable adapter assemblies, and adapter bodies; quick-lock nuts; spindle extension assemblies; and Toolitrol boards and gages. Dimensions included.

21 VAPOR SPRAY LUBRICANT—*Tower Oil Co, Chicago, Ill.* Bulletin L-8 describes applications of Micro-Moly, a dry lubricant which serves as a protective undercoating where oil and grease are used. Bonds itself to surfaces so as to withstand pressures up to 400,000 psi.

22 INSTRUMENTATION LITERATURE—*Minneapolis-Honeywell Regulator Co, Industrial Div, Philadelphia 44, Pa.* 24-page bulletin 100-D lists catalogs, bulletins, specification sheets, data sheets, and articles from Instrumentation magazine. Contents are broken down into general subject, product, and industry index.

HEAT TREATING AND WELDING

23 ELECTRIC CARTRIDGE HEATERS —*Edwin L Wiegand Co, Pittsburgh 3, Pa.* 4-page bulletin 850 contains description of complete range of Chromalox spot heaters with positive lead wire protection. Styles, sizes and outputs illustrated range from 30 to 2000 watts, from ⅜ to 1¼ in. in dia.

24 AUTOMATIC WELDING MACHINES—*Morton Manufacturing Co, Muskegon Heights, Mich.* 8-page bulletin 53 illustrates and describes units and fixtures for submerged and inert are operations. Features of variety of machines discussed.

PLANT SERVICE EQUIPMENT

25 LOADING PROBLEMS—*Magnesium Co of America, Materials Handling Div, East Chicago 19, Ind.* 4-page illustrated folder provides solutions to 13 difficult dock and yard-loading problems.

26 "METALLOGRAPHIC POLISHING WITH DIAMOND"—*Elgin National Watch Co, Elgin, Ill.* Booklet lists advantages of diamond abrasive over silicon carbides both for rough grinding and final polishing. Particular application to specimen polishing of metallic carbides and other metals.

27 HYDRAFORK TRUCK — *Lewis-Shepard Products, Inc, Watertown, Mass.* 16-page Fall issue of Lever magazine illustrates and describes wide range of materials handling equipment, including new electric fork truck equipped with hydraulically operated forks which extend to pick up, retract, and deposit the load.

28 MACHINERY MOUNTS—*T R Finn Co, Industrial Div, Hawthorne, NJ.* 4-page catalog FP-55 contains illustrated data on Finnflex Foating Pillow line of vibration mountings for medium and heavy weight machinery. Construction details, load capacities and frequencies, typical installations included.

29 FLEXIBLE METAL HOSE PRODUCTS—*Universal Metal Hose Co, Chicago 23, Ill.* Reference manual, catalog U-233, contains use and application data on complete range of types to compensate for conditions of varied pressure, elevated temperature, motion, vibration, for variety of conveyance problems.

PARTS AND MATERIALS

30 ELECTRONIC CONTROLS—*Dynamatic Div, Eaton Manufacturing Co. Kenosha, Wis.* 16-page illustrated bulletin EC-1 contains simplified information on installation, performance, and maintenance of basic Dynamatic control. Describes principles used to accomplish stepless speed control of Eddy-Current rotating equipment, using an AC line as power source.

31 STAINLESS STEEL — *Allegheny Ludlum Steel Corp, Pittsburgh 22, Pa.* 10-page technical study covers AM 350, a chromium-nickel-molybdenum stainless, hardenable by subzero cooling or double aging. Tabular data on mechanical properties; corrosion rates; effects of cold rolling and aging on hardness and tensile properties included.

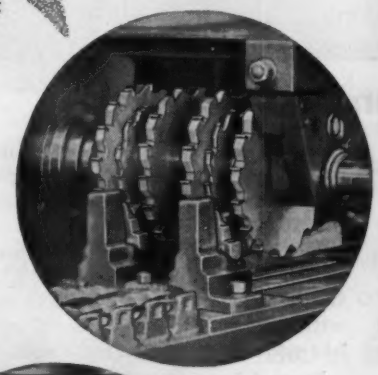
32 3-DIMENSIONAL CAMS — *Parker Stamp Works, Cam Div, Hartford, Conn.* 4-page folder describes evolution of 3-dimensional cams from theory to working finished product. Illustrations indicate infinite number of stations possible on these units.

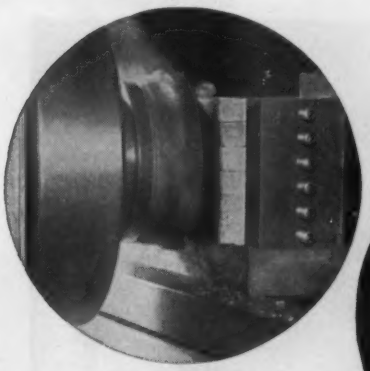
33 RELAYS—*Iron Fireman Mfg Co, Electronics Div, Portland 2, Ore.* 12-page illustrated catalog describes high-speed, sensitive relays. Operational charts with instructions for use included. Dimensional and wiring diagrams given.

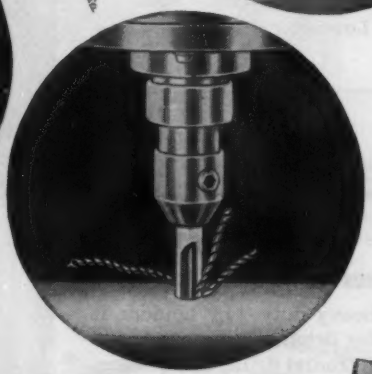
HERE'S THE "Payoff Point" ON ANY MACHINE!

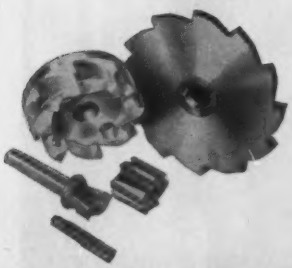
Production speed, product quality and economy depend on one single factor—THE TOOLING IN THE MACHINE!

Nelco carbide tipped tools make *any* machine tool more efficient, more productive. On a new machine, Nelco tools give *maximum performance.* The tool, and be sure it's Nelco, is the PAYOFF POINT on any machining operation. Nelco tools are built to cut—and keep on cutting—to close tolerances and schedules. Finishes are finer; downtime reduced; a size and type for every job a proven fact. For that extra edge in production in new machine or old, look to Nelco at the PAYOFF POINT.









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4 FLUTE DOUBLE END SOLID CARBIDE END MILLS
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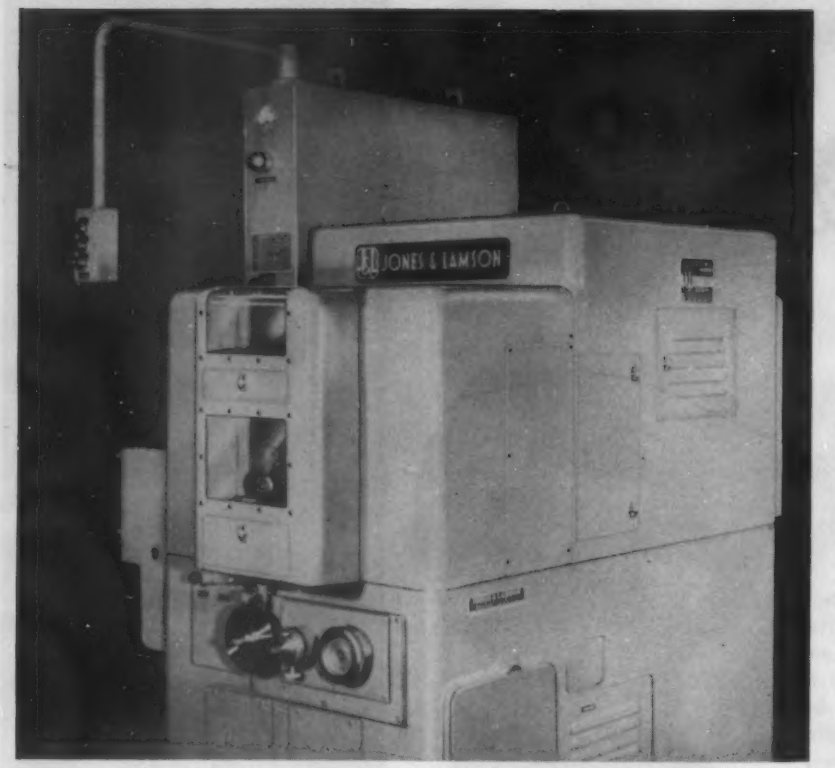
NELCO TOOL CO., Inc. • Manchester, Connecticut



J&L High-Production Tap Grinder

Equipped with automatic work handling, this machine is designed for high-production grinding of standard taps. Work speeds are selected for tap sizes from No. 0 to ⅝-in. dia. Lead screws for each pitch have the pitch of the thread being ground.

Grinding cycles include rapid wheel advance, grinding, and withdrawal, controlled by a single cam. Wheel truing is automatic before or after finish cutting, and is counter controlled when more than one piece is ground per dressing. Wheel sizes are 20, 18, or 16 in.

Work and wheel slides are mounted on antifriction bearings. Wheel slide is held against positive stop with hydraulic pressure. Machine has provision for multiple cuts.

Jones & Lamson Machine Co, Springfield, Vt

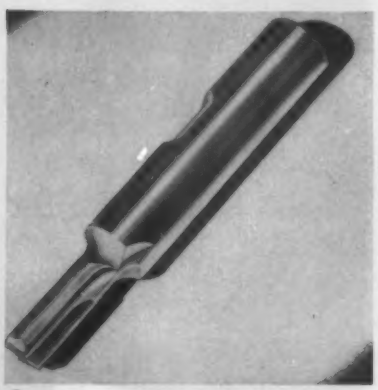
High-Torque Magnetic Brake For Rerated NEMA Sizes

New H style 1000 series magnetic brake is designed for use in 25 to 50-hp range with both old and new NEMA-code frame sizes.

Improved design is said to enable brake to develop more torque in less space than older models, requiring 6 in. less clearance for housing removal than the brake it replaces.

Over-all length is reduced as much as 2¼ in., and weight is up to 20% less. Two sizes are available—125-ft lb and 175-ft lb torque. Brake may also be supplied for floor mounting.

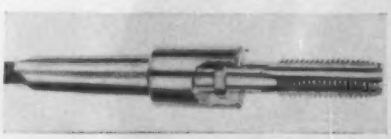
Stearns Magnetic Inc, Milwaukee 46, Wis



Carbide-Tipped End Mills Have Special TS Shanks

End mills, ¼ and 5/16 in., have special heat treated tool steel bodies designed to eliminate breakage of the tool at its thinnest point, and to give added rigidity to shank.

Nelco Tool Co, Inc, Manchester, Conn



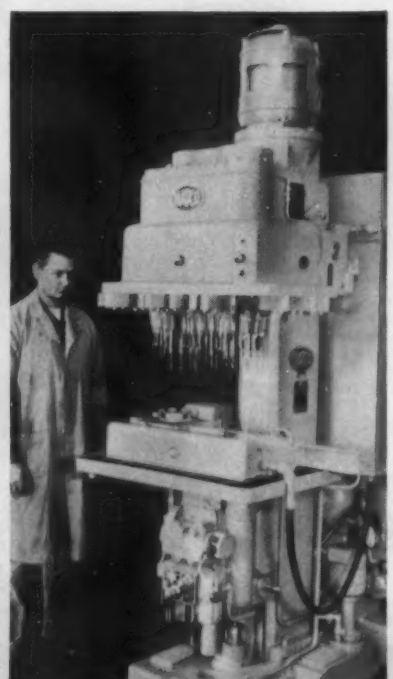
Scully-Jones Heavy-Duty Holders

Line of heavy-duty tap holders is designed for driving large hand- and pipe-taps in radial drills, drillpresses, lathes, boring mills, milling machines, and tapping machines.

New design of snap ring grips shank of the tap, without the use of setscrews, while square on the tap shank fits the broached square of the holder. Concentricity between shank and bore is said to be within 0.002 in. Tangs are induction-hardened.

Drivers are also suitable for reamers, staybolt setters, flue-expanders, and similar tools.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill



NATCO H-6 MULTIPLE-SPINDLE DRILLING AND TAPING MACHINE has 3-position fixture slide which permits drilling, chamfering, and tapping on one machine — *The National Automatic Tool Co, Richmond, Ind*

HY-PRO SPECIALIZES IN TAP SERVICE

AUTOMATIC TABULATION in Hy-Pro's "production control unit" insures prompt handling of your order—and guarantees accurate records for your billing.

YOUR TAP ORDERS are speeded on their way by specialists who know the quickest and safest routes to you and to your distributors.

...to meet the job needs of your shop

Hy-Pro has specialized in the tap business. It has concentrated its operation on *one* line to better serve tap users. Every step a tap must go through—from design to production and shipment to you—is carefully supervised by Hy-Pro specialists.

Whether your needs are for a special or standard order, it will pay you to contact Hy-Pro.

Get in touch with your local distributor, or call Hy-Pro direct. Hy-Pro offers a full line of top-quality taps, backed by the advantage of specialized service.

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HY-PRO

HY-PRO TOOL CO., NEW BEDFORD, MASS., U. S. A.

DISTRIBUTORS IN ALL LEADING CITIES

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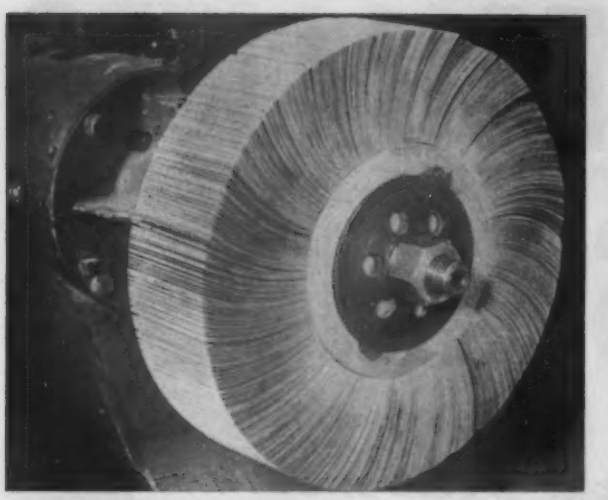
University 4-1077

11232 Lawler St. (Worth)
CHICAGO, ILL.
Garden 4-0217

109 Edison Pl.
NEWARK 5, N. J.
Market 2-4318



3M "PG" Abrasive Wheel Polishes, Grinds

"PG" wheel — so called because it both polishes and grinds—consists of hundreds of pieces of cloth-coated abrasives formed into a wheel that is designed for use on rotary or straight-line automatics, or on standard lathes for hand polishing jobs.

The wheel removes some stock as part of the polishing action, permitting removal of mild draw marks during buffing. Rate of cut and micro inch finish are said to remain constant throughout life of wheel, without increase in rpm as wheel wears.

Wheel is adaptable to hand or automatic operations, and is said to take the shape of the part being polished. Lubrication is with straight oil.

Wheels are available in 20 stock sizes, with diameters from 14 to 17 in., 2, 3, 4, 5, and 6 in. wide. Currently two coatings are available —aluminum oxide and silicon carbide, in a full range of grits.

Wheels are mounted on a hub assembly which can be adapted to spindle.

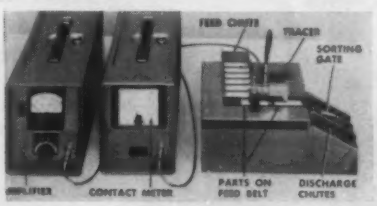
Minnesota Mining & Manufacturing Co, 900 Fauquier St, St Paul 6, Minn

Self-Contained Barrel-Finishing Unit Fits 40x26-in. Floor Area

Space-Miser barrel-finishing unit is designed for use where floor space is at a premium, and fits into 40x26-in. area. Over-all height is 48 in., with 34-in.-high work level.

Barrel is available in one- or two-compartment models, with workload capacity of 1.9 and 0.95 cu ft respectively. Barrel is 20 in. long, 14 in. in diameter. Motor is 1/3 hp, 110v, single-phase. Sump settling drawer is provided with 3 compartments and outlet to existing drains.

Speed-D-Burr Corp, Glendale, Calif



Profilometer Units For Automated Equipment

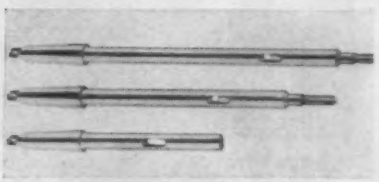
Profilometer device is designed for use with automated setups, gaging parts for surface roughness as they leave the machine. Parts are fed from feed chute onto conveyor belt which moves them beneath a Profilometer tracer. As parts leave the tracer, they are directed into "accept" and "reject" discharge chutes, according to whether they are within acceptable roughness limits.

Equipment can be supplied to sort parts into two kinds of categories. As shown, parts that are above a given roughness are rejected, while all others are accepted. The other possibility is to sort parts so that the only acceptable work falls within a given range of roughness, with parts being rejected when they are both too rough and too smooth to be acceptable.

In addition to measuring and sorting equipment, auxiliary items can be supplied, such as equipment for sampling, or checking one part out of a given number in the production line; signal lights; and controls to shut down the line after a given number of parts are rejected.

Bulletin LT 16.

Micrometrical Manufacturing Co, 345 S Main St, Ann Arbor, Mich



Scully-Jones Close-Center Tap Drivers and Chucks

Close-center and hard-to-reach tapping jobs are said to be easier to do with these tap drivers and chucks, available in short, medium, and long series. Diameter of the driver is slightly larger than that of the tap.

Chucks in this series are split on four sides, providing collet action on the shank of the tap. Square on the tap engages the broached square of the chuck, and shanks of driver and chuck are tanged to provide positive drive.

In assembly, driver and chuck are said to run true within 0.002 in.

Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill

"Economical Buying of Screw Machine Products Now Calls for Greater Care in Specifications,"

says Leonard Schaffer, President, Mechanical Art Works, Inc., Newark, New Jersey

A few typical fine-finish, close tolerance screw machine products currently produced from ANACONDA Rods at the Mechanical Art Works.

"The tremendous versatility of automation in modern manufacturing has placed a bigger burden on the designer and buyer of screw machine parts," Mr. Schaffer explains. "The trend toward miniaturization has shifted many more parts to the screw machine. And the screw machine's ability to provide *tolerances* as close as .0005", and finishes heretofore obtainable only by centerless grinding, has left a tremendously wide choice in specifications."

Mr. Schaffer, a long-time user of Anaconda products, says, "I can count on the uniform machining characteristics of ANACONDA Rods from batch to batch, which is important for both quality and economy in my business."

For complete data on composition and machinability of standard ANACONDA Alloys, standard specifications, weights and dimensions of standard rods, write for Publication B-14. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5583

A few of Mr. Schaffer's suggestions to buyers of screw machine products for keeping costs down.

Wherever possible, the largest diameter of the piece should correspond to a standard stock rod diameter.

Avoid fancy shapes calling for expensive forming tools.

Use hole diameters obtainable with standard tools.

Allow commercial tolerances if possible, otherwise specify tolerances no closer than necessary.

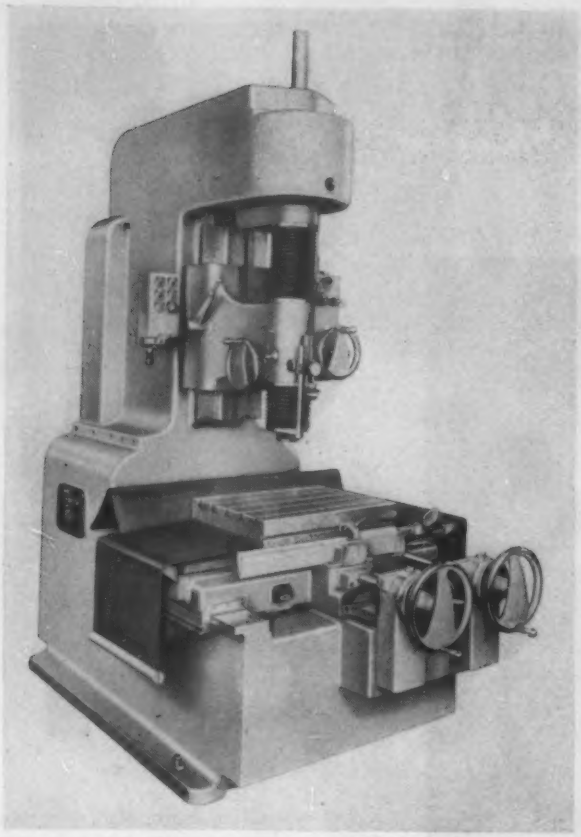
Specify Standard National Coarse or National Fine Threads wherever possible.

On external threads, cutting full threads close to a shoulder is expensive —and may be unnecessary.

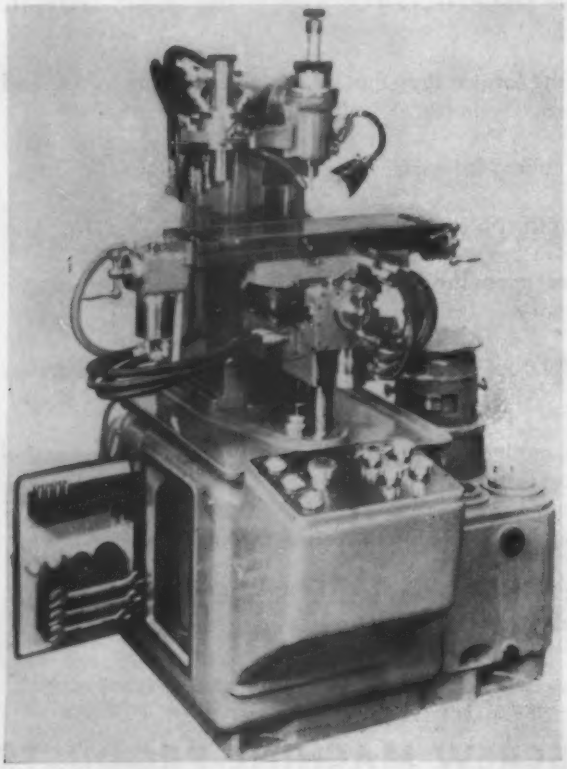
Tapping blind holes close to the bottom is difficult and costly.

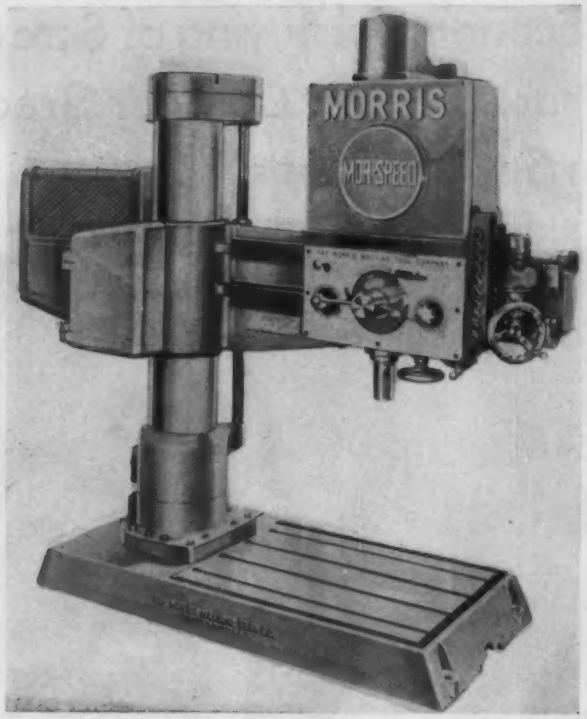
Specify free cutting material unless special physical properties are required, then select the best machining material containing those properties.

ANACONDA® RODS FOR SCREW MACHINE PRODUCTS



NO. 25 JIGMASTER JIG BORING MACHINE is said to have high speed tool changing, fast table settings, and convenient controls. — *W B Knight Machinery Co, Vandeventer & West Pine, St Louis, Mo*





Morris Radial Drillpresses Have Preselective Speeds, Feeds

Pushbuttons replace conventional levers and handwheels on the 13-, and 15-in.-column Hydra-Power radial drills, when raising or lowering arm, traversing head, clamping arm, head, or column, and shifting gears.

Preselective speeds and feeds permit operator to dial speed and feed of next operation while machine is in motion. When current operation is done, a button is pushed, and shift to new speed and feed is made.

Spindle is equipped with an adjustable counterbalance to offset extra weight of special tools and adapters. Automatic tool ejector permits quick tool changes. 36 spindle speeds are in any of 4 ranges. Machine has 18 feeds, including 8, 11½, 14, 18, and 27 tpi leads.

Drill arm cannot be raised or lowered while clamped. Safety stops prevent overtravel of the arm during raising or lowering, and head overtravel during traversing. Safety nut indicates limit of wear on elevating nut. Hydraulic interlock prevents gear changing while spindle is rotating.

Morris Machine Tool Co, 933-16 Harriet St, Cincinnati 3, Ohio

Wickman-Hayes Profile-Miller Has Infinitely Variable Feed

Tracemaster profile-milling machine is designed for 3-dimensional copy-milling of various materials including dies, plastics, molds, and other shapes.

Copying valve operates from master rise and fall of knee, and speed of table traverse. Speed is set by hand controls. Table is reversed at end of stroke by adjustable stops. Infinitely variable cross feeds are from 0.005 to 0.250 in.

Spindle and drive gears are alloy steel, said to permit use of cutters to ½-in. dia. Self-contained hydraulic unit is of Vickers-Detroit design.

Wickman Products Corp, 10325 Capital Ave, Oak Park, Detroit 37, Mich

the DeLaval Separator Company .....

OF POUGHKEEPSIE, NEW YORK

emphasizes TWO IMPORTANT POINTS
about their several

SIDNEY LATHES

1.
"It has an extremely solid construction which gives a good finish so that very little polishing is necessary."

2.
"It has been accepted by our operator and personnel within the department as a machine of clean, rugged design."

SIDNEY MACHINE TOOL COMPANY
over 50 years
of service to
AMERICAN INDUSTRY
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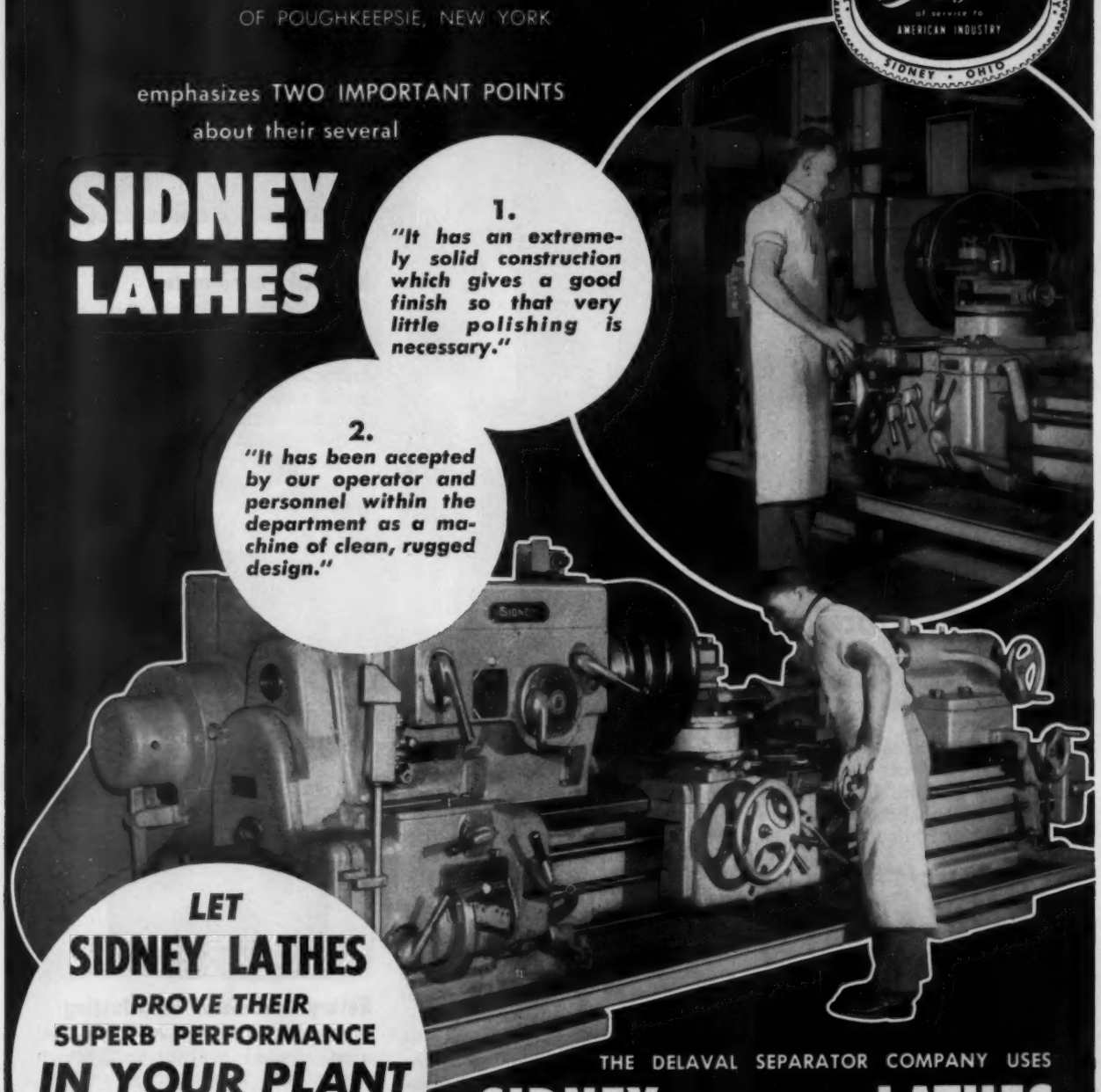

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SUPERB PERFORMANCE
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MORE WORK PER HOUR..
AT
LOWER COST PER HOUR

THE DELAVAL SEPARATOR COMPANY USES

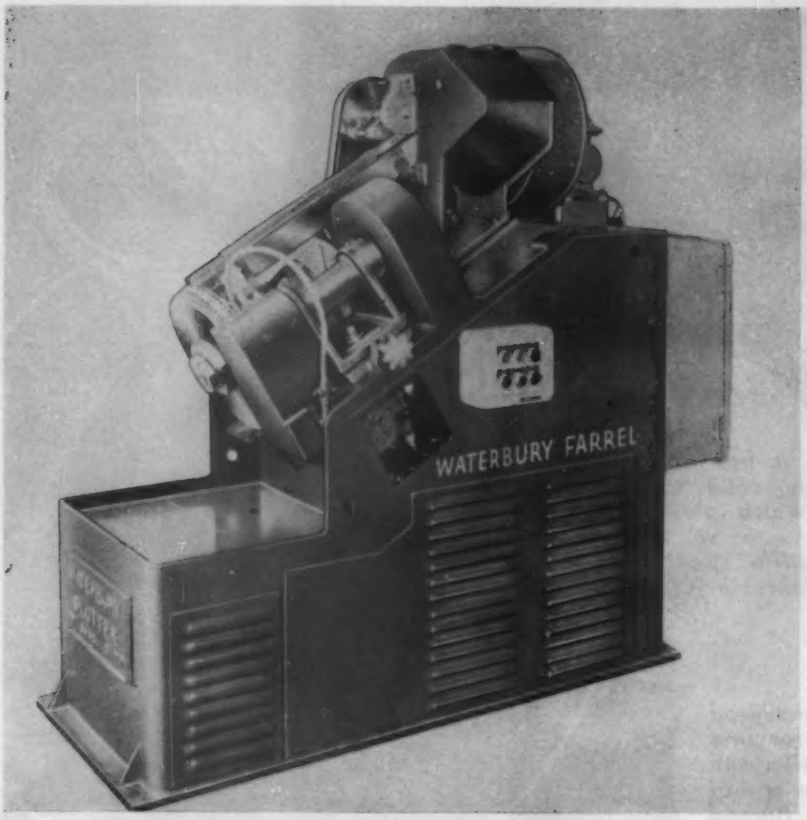
SIDNEY FLUID TRACER LATHES

to make form punches and dies . . . . with the satisfactory results mentioned in their comments. All Sidney Lathes are designed throughout to provide unusual strength which insures long life and years of satisfactory performance.

Write for Bulletins

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



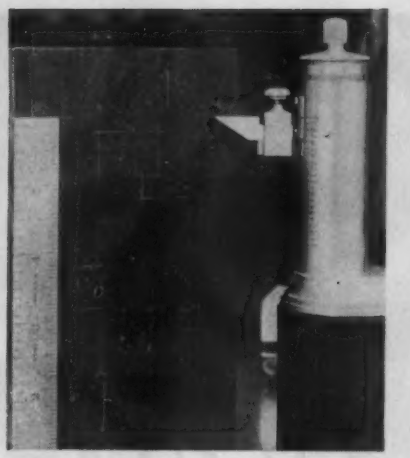
Screw-Slotting Machine Has Higher Production Rate

Model 5 screw-head slotting machine has production rate to 864 blanks per minute, exceeding the capacity of earlier models.

Machine slots standard or special, headed, ferrous or non-ferrous blanks, No. 6 to ¼-in. dia, up to 2½ in. long, at variable production rates from 60 to 864 per minute. One dial, furnished as standard equipment, feeds this range of work diameters. Special dials will handle other blank diameters.

Only tooling required is saw and burr-remover blades, made from spring steel.

Waterbury Farrel Foundry & Machine Co, Waterbury, Conn



Micro-Height Gage Graduations Read Like Micrometer

Micro-Height gage has 2-in. direct reading in thousandths, and is read the same way as a conventional micrometer. Reversing the scriber gives gage 3-in. height, and added 3-in. riser extends capacity to 6 in.

Use of dial indicator instead of scriber permits gaging hole heights.

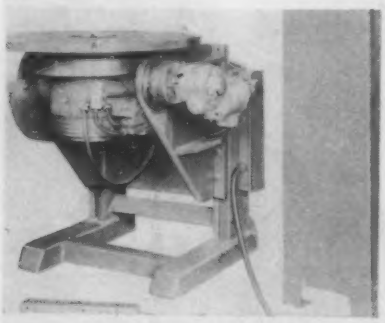
Greist Manufacturing Co, New Haven, Conn

Rotary Automatic Wet-Blasting

Electronic receiving tubes are wet-blast cleaned in this unit, which blast-cleans, rinses, dries, and unloads about 1200 parts per hour. All chemical cleaning is said to be eliminated.

Six-station, air-operated rotary indexing table is mounted vertically within the cabinet. Each station carries a work-holding spindle which supports a chuck which, in turn carries the tubes through the separate baffled operating stations. Different fixtures are available to adapt the unit to other work.

The Cro-Plate Co, Inc, 747 Windsor St, Hartford 1, Conn



Sciaky Weld-Positioner Has High-Responsive Drive

WP-1 weld-positioner is designed for welding cylindrical or circular part. Hollow center table has 9-in. ID, 40-in. OD, with 2500-lb capacity. Table is capable of 360° rotation, and 135° tilt.

Maximum table speed is 2 rpm, minimum speed is 0.1 rpm. Drive is ¾-hp dc motor direct-geared to table. Stopping action is electronic armature regenerative braking. Drive motor power is supplied by rectifier with 60c, 220/440 v input.

Positioner rotation tilt is driven by 440v 3-phase, 60c motor with precision limit switches and mechanical stop to prevent overriding. Tilt motor has forward and reverse motion, with jog and inch action in either direction.

Precision limit switch is used for automatic stopping of the positioner at the end of a circumferential weld. Switch is actuated by adjustable trip located to permit up to one complete revolution in either direction.

Model WP-2 is identical to WP-1, except for semi-feedback control.

Sciaky Bros, Inc, 4915 W 67th St, Chicago, Ill

KEMPSMITH MASTER-MILL

It's **NEW**
It's **MODERN**

The Hit of the Show at Chicago!

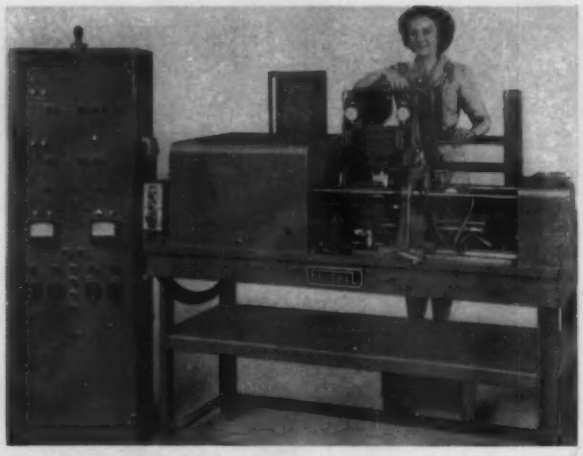
The enthusiastic reception accorded the new Kempsmith MASTER-MILL at the Machine Tool Show is now history. Thousands of production-minded visitors witnessed the demonstration of this modern milling machine. They agreed, the Kempsmith MASTER-MILL is the finest, most efficient, most productive milling machine of its size and horsepower on the market today, regardless of price. It cuts milling costs to rock bottom by fully utilizing modern cutting tools and techniques. Conveniently located controls permit more rapid set-ups, thereby providing more cutting time. Low initial cost, plus economy of operation, assure highest return on investment. Now available in sizes No. 2 and No. 3—Plain and Universal models. For descriptive literature on these modern milling machines write:

KEMPSMITH MACHINE CO., 1823 So. 71st St. Milwaukee 14, Wis., U.S.A.

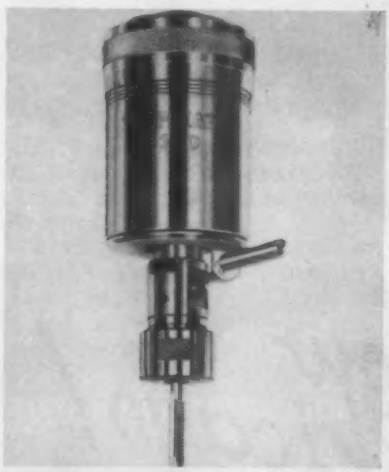
Precision-Built MILLING MACHINES Since 1888!

A 8501-1PC

IMPLEMENT PUMP BODIES are drilled, chamfered, reamed, end-milled, trepanned, tapped, and rough and finish bored, at the rate of 8520 operations per hour on this machine. Fixture is 11-station, power-operated, with interchangeable details for the parts involved. Machine is said to be built largely of standard components. Built to JIC electrical and hydraulic standards—*Michigan Drill Head Co, PO Box 4643, Detroit 34, Mich*



PUSH RODS are checked and sorted in this Federal gaging unit, which checks six conditions. OD is gaged and hardness checked at both ends, and over-all length and straightness are measured. Good, salvage, and scrap parts are automatically sorted. Good parts go to conveyor, while scrap and salvage parts go into separate bins. Rate is 2500 parts per hr. Percentage counters at each station cause lights to flash and relays to shut down offending process machine when percentage of rejects exceeds the allowable limit at any particular station—*Federal Products Corp, 1144 Eddy St, Providence 1, RI*



Tapmatic 700 Attachment Has ¼ to ½-in. Capacity

Attachment is larger version of Tapmatic 300 and 500, operating on "weightless tapping" principle, requiring no pressure by operator during the tapping cycle.

Positive-torque spring-loaded ball adjustment clutch stops tap when dull, loaded, or when it hits a hard spot or bottoms in a blind hole.

Reversing mechanism is said to permit instant withdrawal at any time, and is designed so that the reversing torque is automatically adjusted simultaneously with the driving torque through one adjustment of the clutch.

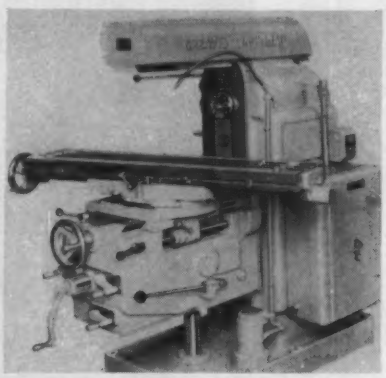
Device incorporates Jacobs Rubber-Flex tap chuck, and does not require individual tap holders. No. 3 Jacobs taper is standard, but Morse taper arbors can be furnished.

Tapmatic Corp, 845 W 16th St, Costa Mesa, Calif

Low-Cost Router For Light Jobs Has 24,000-rpm Motor Speed

Model 53510 is a low-cost router for light industrial use. The tool weighs 2½ lb, and has 0.250-in. capacity, with a motor speed of 24,000 rpm, 115v ac. Tool comes equipped with motor, base, guide, nuts, and screws. Handles and bits available at extra cost, and a ⅜-in. adapter may be used with the router. Price, $19.95.

Mall Tool Co, 7725 S Chicago Ave, Chicago 19, Ill



Greaves 2-XH Milling Machine Has Separate Drive Motor

Model 2-XH milling machine is available in either plain or universal model. Machine has separate drive motor, mounted in the knee, for knee, saddle, and table power.

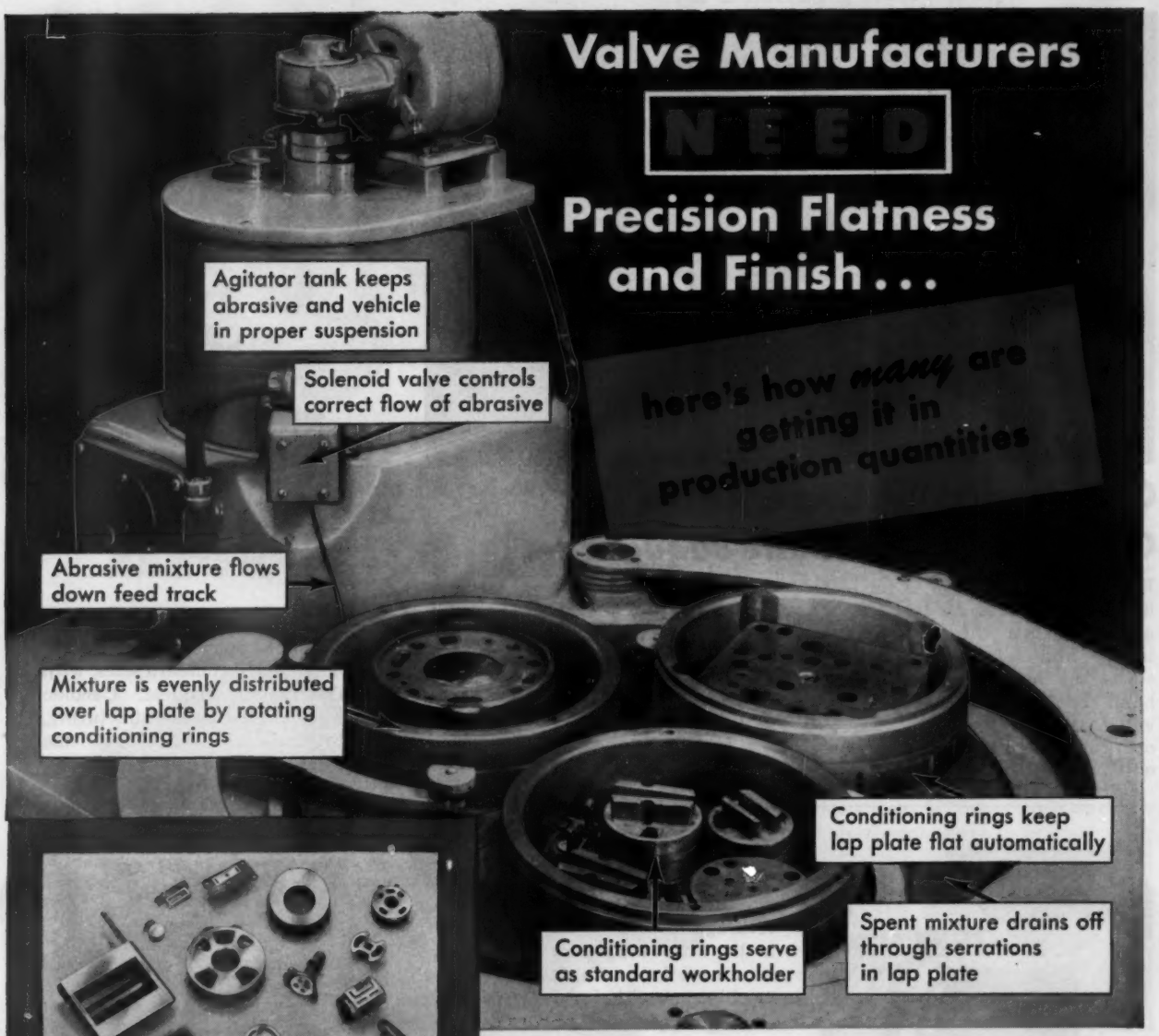
Machine uses three bearings on the horizontal spindle, including two Timken bearings.

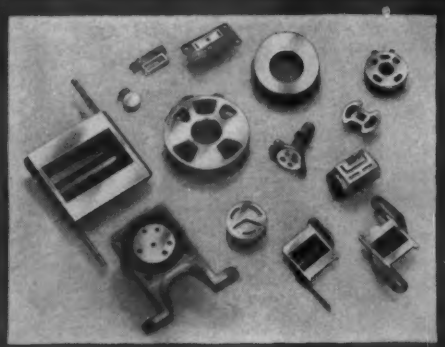
Vertical table travel is 20 in. Machine also has centralized power controls for all directional feeds, totally enclosed vertical screw, push-button spindle rotational control, electrical control for jog, stop, and continuous operation, one-shot plunger lubrication to table saddle, and coolant sump with built-in filter.

The Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio

Valve Manufacturers NEED Precision Flatness and Finish...

here's how *many* are getting it in production quantities


Agitator tank keeps abrasive and vehicle in proper suspension
Solenoid valve controls correct flow of abrasive
Abrasive mixture flows down feed track
Mixture is evenly distributed over lap plate by rotating conditioning rings
Conditioning rings keep lap plate flat automatically
Conditioning rings serve as standard workholder
Spent mixture drains off through serrations in lap plate



A great many valve manufacturers are included in the more than 500 producers of industrial equipment using Lapmasters. All have found this machine to be the answer to obtaining precision flatness, finish and parallelity in production quantities. Types of valves include gate, slide, hydraulic, solenoid, rotary, diaphragm, etc. The high production accuracy of the Lapmaster (micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011" when required) is being definitely achieved on all materials including cast iron, steel, stainless steel, magnesium, aluminum, brass, carbon, ceramics, plastics and sintered metals. It will pay you to investigate this modern precision, yet economical, method of machining.

Get all the facts

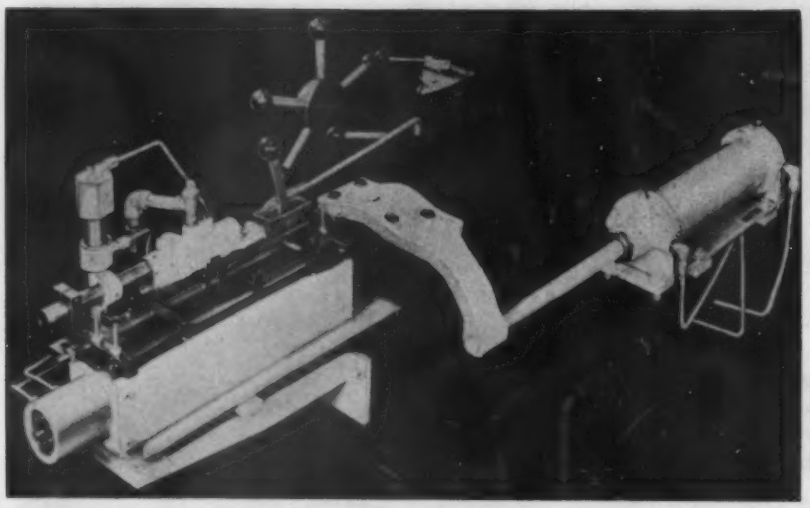
Here are three booklets that will give you the facts on producing and measuring precision flatness and finish. Write for your copies today.

Crane Packing Co., 1836 Cuyler Ave., Chicago 13, Ill.
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont., Canada

Lapmaster DIVISION

CRANE PACKING COMPANY

38 YEARS INDUSTRIAL PROGRESS

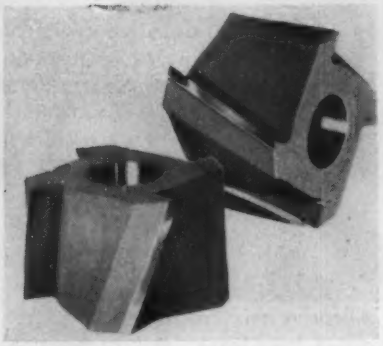


Cash Hydraulic Turret Drive Converts to Automatic Sequence

Hydraulic turret drive is made for hand turret lathes, Models 1, 2, 3, 4, and 5. When the device is attached and set up, the operator starts the machining cycle with a hand control valve. The master valve then controls the required operations in pre-selected sequence, without further operator attention.

The attachment is made for ram-type machines, and consists of control unit, control valve, pump and motor unit, and power cylinder. Pump has 8 gpm, with 1½-hp drive. Metered feed rate is 0 to 100 ipm, with rapid feed rate of 250 ipm.

A W Cash Co, PO Box 551, Decatur, Ill

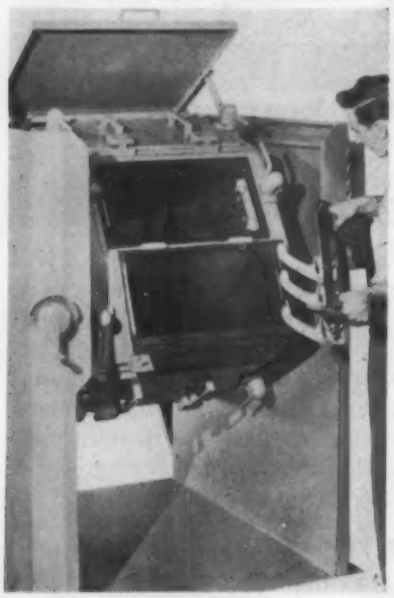


Onsrud Spiral Carbide Mills

Carbide-tipped spiral milling cutters are available in 6 standard sizes, with special sizes on request. Carbide blades are formed by manufacturing, rather than hot-twisting, so the blades are said to have standard metallurgical quality.

Helix angle is 20°, with 15° positive rake angle, on standard cutters.

Onsrud Cutter Manufacturing Co, Libertyville, Ill



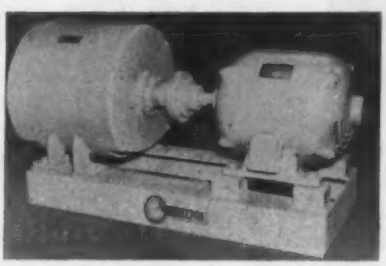
Roto-Finish 8-Door Model For Coloring Aluminum

Stationary-fixture, 8-door finishing machine is designed especially for coloring aluminum castings. Machine has a door on each flat of a single-compartment cylinder. Fixture pads are attached to the octagon side walls of the compartment.

According to the manufacturer, it is not necessary to remove processing media or solution when removing work load from compartment.

Processing compartments vary in size to 48 in. long, 42 in. in diameter. Average size is 32 in. long, 42 in. in dia, which is used for coloring aluminum castings with steel balls. This machine uses 7½-hp drive with reversing electric controls.

Roto-Finish Co, Kalamazoo, Mich

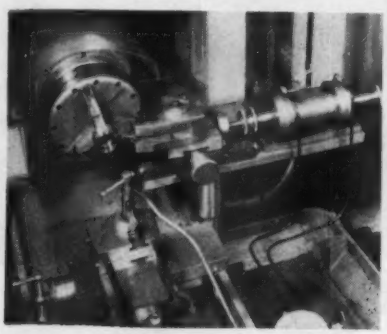


Ultrasonic Generator Produces 2 to 150 Kw at 20,000 Cps

Ultrasonic generator is suitable for supplying power for energizing multiple arrays of above-audible sound-generating transducers, for such jobs as degassing molten metals, plating, cleaning, degreasing, and similar work.

Line of generators is from 2 to 150 kw output, at 20,000 cps. Typical generator has 230 v, 20,000 cps, single-phase output, and is driven by 15-hp, 3-phase, 60c 220/440-v squirrel cage induction motor, and is rated to energize up to 10 submersed 400-watt transducers of any type in a typical cleaning and degreasing system.

Acoustica Associates, Inc, Glenwood Landing, LI, NY



Hydro-Face Attachment For Simultaneous Facing

Attachment for boring machines faces during boring cycle to cut operation time. Standard model has 6-in.-dia capacity in ferrous and nonferrous materials.

Device consists of main unit, which is a hydraulic piston assembly and facing compound slide with micrometer adjustments; hydraulic actuating valve; feed control dial; and hydraulic lines and fittings.

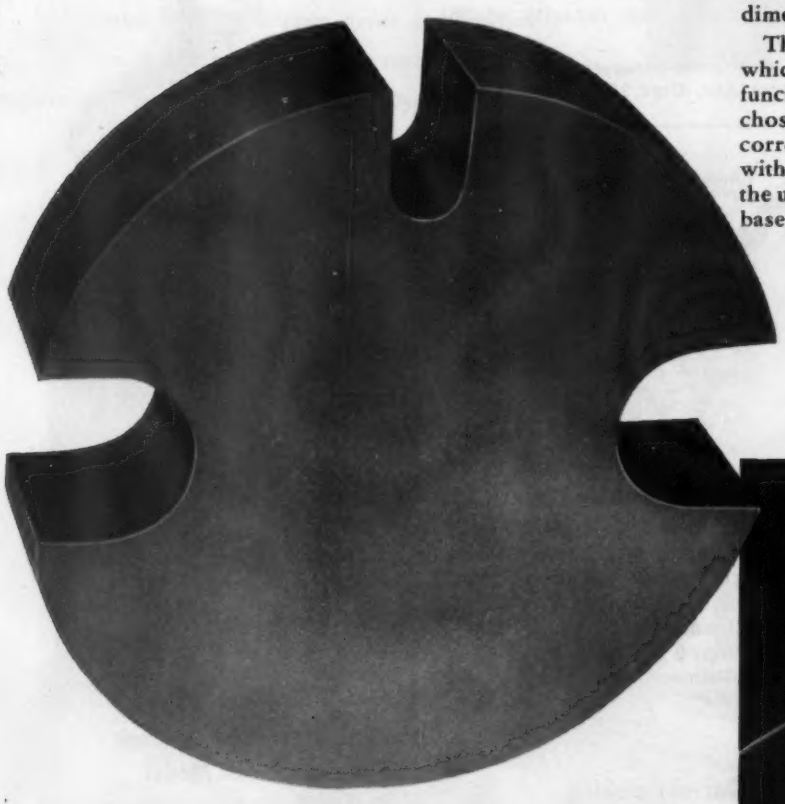
Price, $967.

Belock Instrument Corp, College Point, NY

HEAVY EXTRUDED SHAPE

Saves Over 25¢ per lb.

FOR THE STRONG ELECTRIC CORP.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

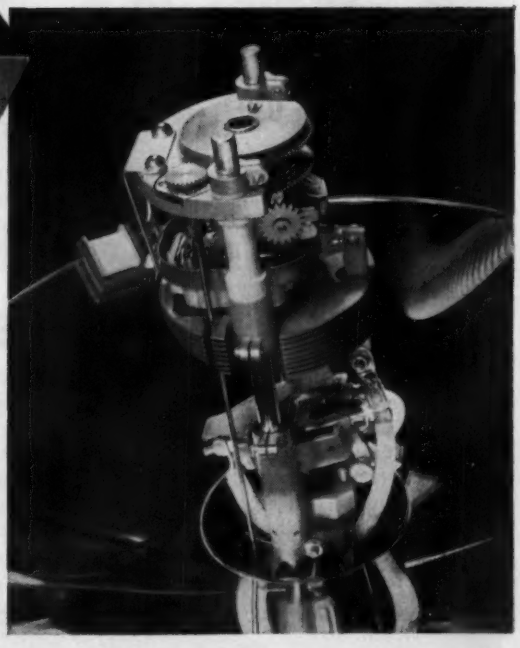
The unusual thing about this copper extruded shape is that it saves money in first cost as well as in machining time. The double economy amounts to over 25¢ per pound. The large illustration shows the shape as supplied in the form of a slug or pre-formed disc, 1 3/16" x 5". This begins as a long extrusion, from which Revere cuts the discs, and pickles them before shipping.

The customer is The Strong Electric Corp., Toledo 2, Ohio, which originally tried plate and bar, but found costs were too high. Revere Product Engineers, Methods and Production Departments collaborated with the company on the problem, and were able to develop the unusually heavy and economical shape. Strong reports a number of savings. One is that the shape is machined quickly and perfectly, with almost no rejects. This is due to the denseness and uniformity of the metal, a result of the high pressures exerted during extrusion. (Finishing operations include drilling bolt holes and cutting cooling fins.) As a secondary result of improved machining, the customer does not have to keep large inventories of metal to take care of spoilage, nor handle large quantities of scrap. Further, Revere supplies the discs in the correct thickness, eliminating a cutting-off operation for Strong. Incidentally, we are glad to supply shapes cut to dimensions, or in long lengths, as desired.

The completed part is an obturator-probe, which fulfills a control and heat dissipation function in a powerful searchlight. Copper was chosen for its ability to conduct heat and resist corrosion. Revere will be glad to collaborate with you in your search for economies through the use of extruded shapes in copper and copper-base alloys, and aluminum alloys.

Copper Extruded Shape, 1 3/16" x 5", as furnished.

Shape in place in a carbon arc searchlight mechanism.

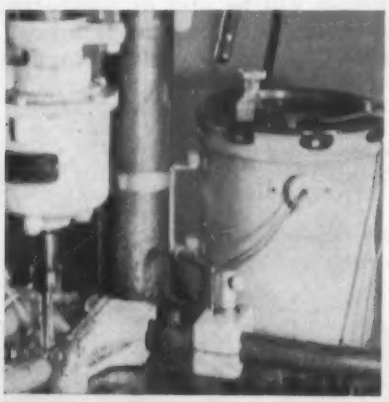


Signode Air-Powered Strapper Adjustable to 1600-lb Tension

Air-powered steel strapping machine automatically tensions strapping and seals and cuts off in two motions. Model AP is said to be particularly useful for strapping skid and pallet loads.

Tension is adjustable to 1600 lb. Tool may be used with either ⅝- or ¾-in. Signode steel strapping. Tool base is die-cast aluminum alloy. Magazine has capacity of 75 seals.

Signode Steel Strapping Co, 2600 N Western Ave, Dept 9P, Chicago 47, Ill

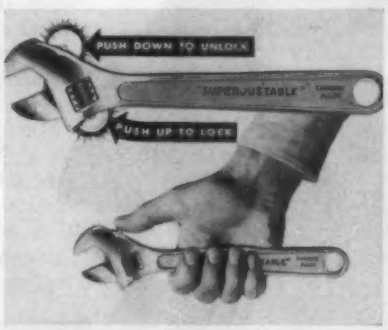


Mistic-Mist Cooling Unit Uses 0.04 cfm Air

Mistic-Mist is a mist-cooling unit operating on 25 to 150 lb air pressure, consuming 0.04 cfm of air. One gallon of coolant is said to last for 14 hr of average use.

Units are available with single or multiple outlets, and the lowest-cost installation is $30.00. With this system, compressed air is passed through a small-diameter tube over the end of another tube of appropriate size, creating a vacuum which siphons the coolant from its container. Mist volume is controlled by a needle valve in the air line. There are no pressure tanks, floor stands, or filters, required with the system.

J R Reinertson & Co, 4744 W Lake St, Chicago 44, Ill



Self-Locking Adjustable Wrench

Wrench is locked in position with thumb or finger, with same method of unlocking. Tools are drop-forged from alloy steel, and are available in 6, 8, 10, and 12 in. sizes, with capacities from 0 to 1 5/16 in.

J H Williams & Co, 400 Vulcan St, Buffalo 7, NY

Newton Barrel-Finishing Compounds

Four classes of barrel-finishing compounds are available, for the various progressive stages of finishing. Class A compounds are for heavy deburring and cutting in the initial stages of finishing. Class B compounds are for regular deburring and semifinishing. Class C compounds burnish, while Class D products have wetting agents and disbursers with high detergency, said to contribute to finer metal color and finish.

Designed for use with all media types, Newton compounds are said to be particularly effective with Newton Polishapes and Burnishapes.

Newton Industries, Inc, 100 Saw Mill Rd, West Haven, Conn

Norton B11 Resinoid Bond For Uniform Wheel Structure

B11 resinoid bond is said to give better uniformity of wheels from lot to lot, and to improve wheel-structure uniformity. This leads to more uniform grinding results, according to the manufacturer, giving better surface finish, lower diamond costs, and better accuracy.

Wheels with B11 bond are available in wide range of hardness grades and sizes, and have been successfully applied to centerless, cam, roll, disk, and thread grinding.

Norton Co, Worcester 6, Mass

Motor-Driven Rivet Spinner In Floor or Bench Model

High Speed rivet-spinning machine is available in either floor or bench model, designed for foot or air operation. Machine is said to be noiseless, with rivet capacity to 5/16-in. diameter, with ¾-in. spindle travel adjustable downward.

Inset shows machine being used with air-operated vise holding assembly being riveted.

High Speed Hammer Co, Rochester, NY

Wade®

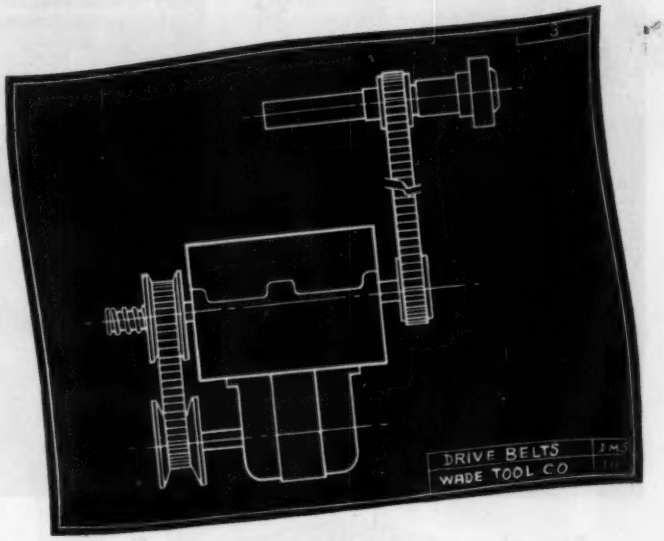
you can speed up production with this

HAND TURRET LATHE

You'll be agreeably surprised at the remarkable increase in your production (and therefore profits) now possible with this modern lathe. Here are a few of the reasons why:

★ Lathe is equipped with a single speed motor which runs in only one direction, the cast iron variable pitch pulleys acting as a flywheel to provide *instantaneous reverse and speed changes.*

The combination of two belts, as illustrated, with clutches gives a high-low speed change and a fast reverse, insuring *maximum production from this type machine.*



★ Spindle driven by Gilmer steel-cabled timing belt. (Positive drive, cog-tooth design — no belt tension required.)

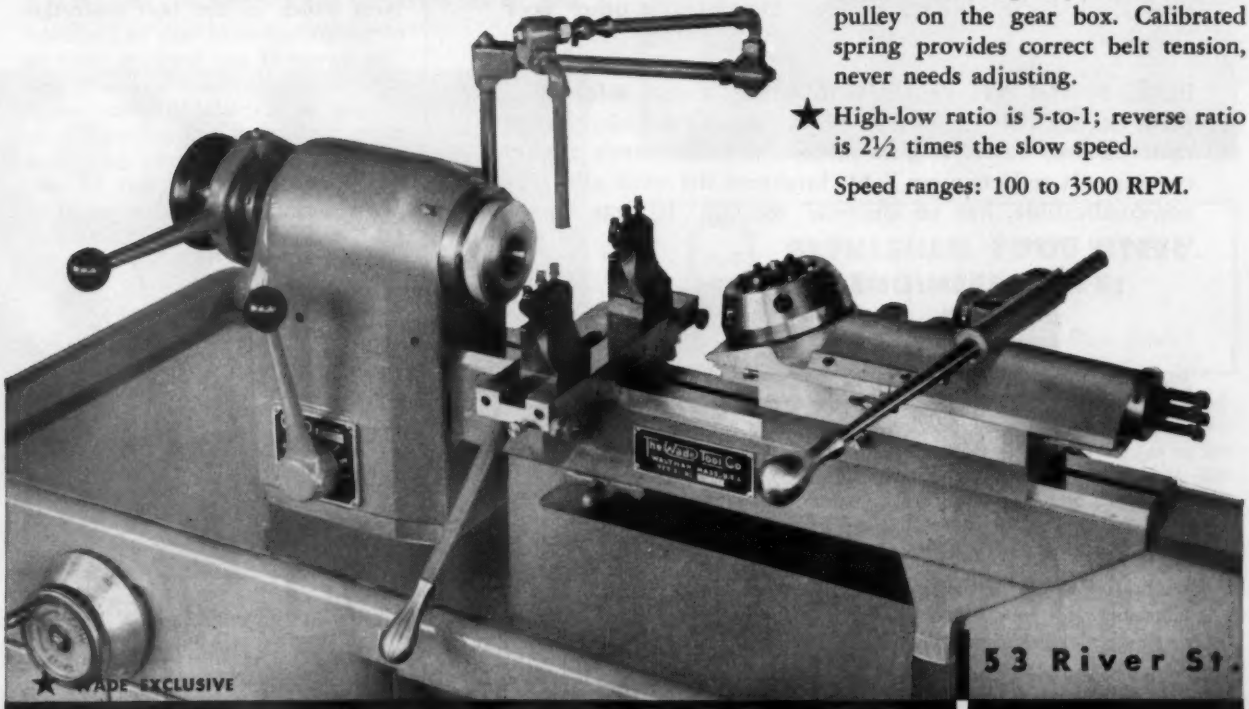
Variable speed pitch pulley belt connects the motor pulley and the driven pulley on the gear box. Calibrated spring provides correct belt tension, never needs adjusting.

★ High-low ratio is 5-to-1; reverse ratio is 2½ times the slow speed.

Speed ranges: 100 to 3500 RPM.

send for literature

no. 73 HAND TURRET LATHE



★ WADE EXCLUSIVE

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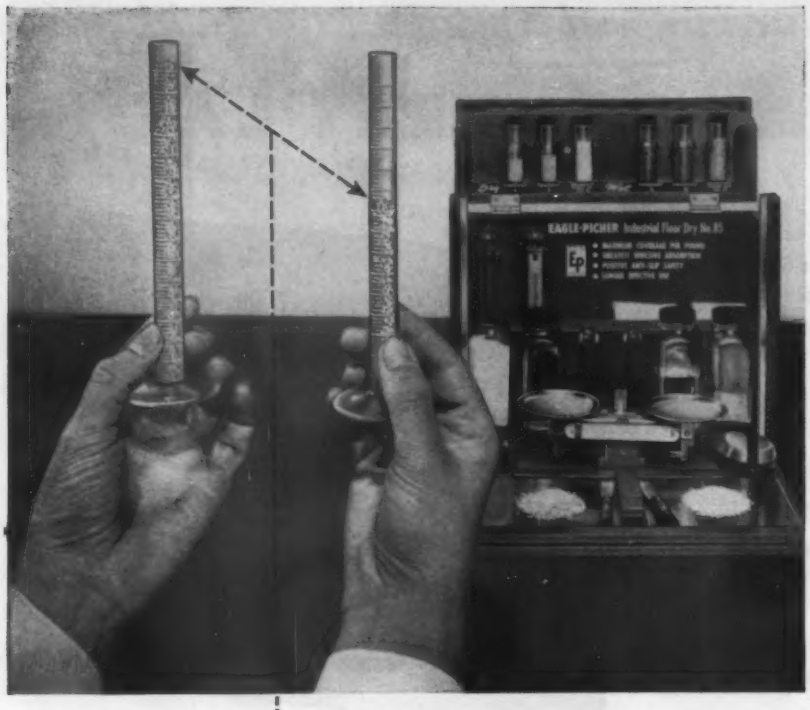
MAKERS OF PRECISION MACHINE TOOLS FOR AMERICAN INDUSTRY



There's a BIG difference in floor absorbents

TEST IT Yourself!

IN YOUR OWN OFFICE, make this simple 15-minute test. Compare Eagle-Picher Industrial Floor-Dry to any other floor absorbent.

HERE'S WHAT YOU'LL PROVE TO YOURSELF about safe, skid-proof Eagle-Picher Floor-Dry: It's extremely insoluble, absorbs more oil and water. It goes further, provides much greater coverage. It reflects more light, brightens the work area. It's non-combustible, has no chemical reaction. It lasts longer, saves you money!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Cincinnati 1, Ohio.

ROUND TABLE Discussion

RUMOR BOARD

Can rumors be dispelled by an official company explanation posted on something similar to a bulletin board? Will employees accept such an explanation, or view it with a jaundiced eye as just some more management propaganda?

A RUMOR BOARD is not necessarily going to put an end to the circulation of rumors. Regardless of what notices a company might post about its plans, rumors and speculations are capable of arising and being voiced by the employees, growing or diminishing as they are passed from one person to another. When people converse, speculations are bound to come and information from mouth to mouth will probably never return to its originator exactly as he said it.

Should a rumor arise which causes dissension, the employer can best straighten this out by bringing those concerned together in a closed meeting and ironing the problem out by open discussion and presentation of the facts. By presentation of the facts, however, is meant only those facts which in the best discretion of the management may be disclosed. The owner of any business must be able to keep private anything pertaining to his establishment which might endanger the success of his business by disclosure. Any individual may find it necessary for various reasons to keep his financial affairs and ventures private, and this,

"What do you mean, Subconsciously you're hard at work?"

Tool Steel Topics

BETHLEHEM STEEL

Circle Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Production Up 50 pct with Bearcat Riveting Tool

For some time a manufacturer had been using a tool made of alloy steel, 2⅛ in. round, to cold-rivet weight-lever sets, 1 7/16 in. sq, for railroad switch stands. The tool was used in a series of rotating blows, average production being 70 pieces per tool before redressing was required.

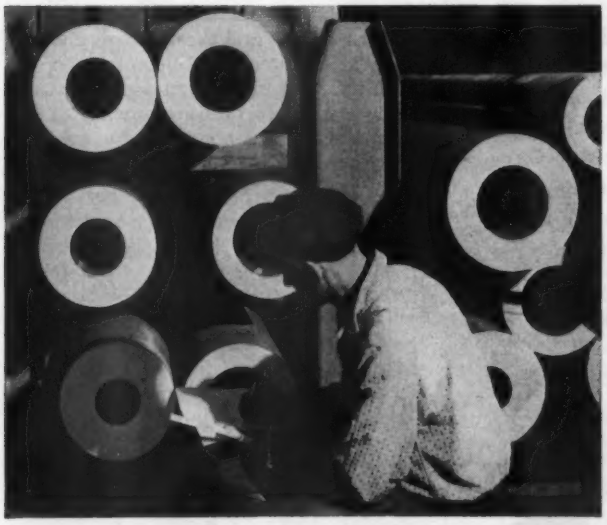
As the operation clearly called for steel with exceptional resistance to shock and wear, we suggested, "Why not give Bearcat a trial on that job? Bearcat's got the toughness you want. What's more, we wouldn't be surprised if it gave enough longer life to bring down your costs."

They made the change, with the result that tool life increased about 50 pct.

Bearcat is a tough, general-purpose grade of air-hardening tool steel. It has exceptional resistance to shock, and superior wear-resistance. Its air-hardening characteristic minimizes quenching hazards, and also provides good resistance to distortion in heat-treatment.

In addition to cold-riveting tools, there are many other applications in which Bearcat gives a good account of itself — in such tools, for example, as chisels, gripper dies, master hobs, hot headers, and die-casting die inserts.

Why not look into Bearcat? You can obtain full information from your Bethlehem tool steel distributor.



Save Time with Hollow-Bar in Ring-Type Applications

If you use draw rings, hardened bushings, ring dies or the like, you'll find you can save time in the shop with Hollow-Bar Tool Steel. Bethlehem Hollow-Bar comes in two types: BTR (oil-hardening) and Lehigh H (high-carbon, high-chrome). It's made by a high-speed trepanning process, which cores out the inside diameter of hammer-forged or hot-rolled, rough-turned bars. Hollow-Bar goes to work for you immediately. There's no waiting for forged rings or discs — nor are drilling, rough boring or facing, or rough turning required. Just think of the time that saves!

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's a Quick Look at Short-Run Dies

There are many types of dies used for blanking or forming where the production required may be only a few hundred pieces, or less. Such requirements occur frequently, as in the aircraft industry, for example. In such circumstances, the normal procedure of machining a die, then heat-treating and grinding it (to produce a die good for millions of parts) is neither practical nor economical. What is desired is a steel which can be machined to size, then used immediately.

One of our standard grades which is ideal for this application is Brake Die Tool Steel. Brake Die comes in rounds, squares and flats. It is a free-machining steel, and has been heat-treated at the mill to the highest hardness possible consistent with good machinability. On forming operations, dies made of Brake Die will last for tens of thousands of parts. And on blanking operations, it will produce anywhere from a few hundred parts to a few thousand, depending of course upon the type of material being blanked, and its thickness.

Tough Sprayed Metal

well-known maintenance method now profitable production process

equipment fabricators find tough, high-quality sprayed metals build big bonus pay-offs

Modern metallizing—metal spraying—which for many years has saved millions of maintenance dollars by restoring worn machine parts for thousands of companies, is now helping many others improve their products, cut production costs.

In the production of new equipment, tough sprayed metal coatings provide highly desirable mechanical or electrical characteristics at low cost, in high speed, semi-automatic production.

General Electric, for example, a long-time user of metallizing to provide superior wearing qualities on critical areas of large turbine shafting, now applies sprayed metals to a wide range of its products. Many forward-looking companies have instituted investigative programs in their research and design labs to explore the use of metallizing as a means of giving their products competitive advantages in quality, or performance or price—or all three.

Metallizing may be able to help your company improve its products, economically, reduce machine maintenance costs, cut your bills for corrosion protection. It may pay you well to look into it. In any event you will find it a fascinating subject. Bulletin 51 illustrates and describes "Metallizing—its practical applications"—shows actual work being done in users' shops. We shall be happy to send you a copy.

For engineering data see opposite page.

METCO®

Metallizing Engineering Co., Inc.

1169 Prospect Ave., Westbury, L. I., New York • cable: METCO

In Great Britain: Telephone: EDGEWOOD 4-1300

METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

of course, applies to the owner of a business.

It is always helpful to both employer and employee when the employee is well informed about his job. It lies with the employer to decide just what information disseminated will be most helpful to the successful running of his business from an over-all viewpoint. This does not mean that he is neglecting his employees; on the contrary, he is making for a better business which will be reflected in better pay and opportunities for each of his employees.

False and true rumors can cause trouble it is true, but these problems can for the most part be cleared up by a just and forward-looking management pushing ahead with its plans and meeting rumors honestly but circumspectly.

Francis Beck
New York 9, NY

MANAGEMENT, by its psychological inactivity, is open to the damaging annoyances of the subversive elements which are constantly eager to capitalize on any rumor started from any source—whether a thoughtless jest or purposely instigated with one end in view.

There was a time when I looked upon a woman as being the weaker sex, but after working around in shops throughout the country for a good many years I have come to the conclusion that they are the stronger. There are a certain few tongue-waggers—you'll find these among the uneducated who haven't been trained in the value of expression—who just simply delight in fanning any bit of gossip they might hear. To my way of reasoning it's nothing more than

"Today is the first time in six years that you've met the quota . . . believe me, that calls for a celebration!"

a form of disease that is as contagious as smallpox. There is no form of inoculation for this other than a planned campaign by the employer which, in essence, consists in building up confidence among his workers by enlightenment.

The biggest percentage of workers are broad-minded enough to sense the source of trouble-making rumors and treat them with a grain of salt however, these rumors will persist i some measures are not taken to stop them at their source.

Rumors start in the strangest manner—that is, the instances which provoke their conception are varied. One, as an example, comes to mind where a meeting was called in which all the foremen were assembled to discuss several matters relative to productive procedure. While the "big wheels" were in a huddle in the front office one pseudo-psychic reasoned that a certain thing was being discussed and lost no time in passing it on to his neighbor on the bench. They say that a rolling stone gathers no moss, but believe me this rumor resembled a fuzzy-topped hedgehog before five minutes had elapsed. Needless to say that the miracle man had missed the mark by a wide margin. These rumors, sometimes starting in jest, are fanned by the gullible and spread out like a forest fire, doing plenty of damage before they are stopped.

I spoke to our plant manager today informing him of the current Round Table — in fact letting him read it — and I asked him what he thought of putting notices at intervals informing the workers of the plant activities and just what was going on among the higher bracket. He felt that it would be a good thing to keep the employees informed in a direct way instead of letting badly-distorted news reach them wherein the true facts would place confidence where it belonged. He also stressed that some things should not be divulged because of immaturity of development. I asked him what he thought of information pertaining to the financial status and he was for it, without any reservations. "If we cannot deal with our workers in such a way as to make them feel that they are members of the firm, then one could not blame them if troublesome agitation arose."

Far superior than a posting of information on a bulletin board would be a well-edited plant organ completely devoid of the usual slapstick material invariably found in the well-known plant publications. This serious business publication could have a section on finances of the

here's engineering data on *Sprayed Metals* in electrical and electronic equipment

Metallized zinc provides low-cost, efficient shielding for components of Dictaphone dictating machines.

Metallized copper on ceramic base resistors permits soldering of pigtails. Photo courtesy Friez Instrument Division, Bendix Aviation Corp.

1/16" of sprayed lead on this cast aluminum x-ray housing protects operator from radiation. Any thickness can be applied. Photo courtesy Metal Spraying Corp., Milwaukee, Wis.

Modern metallizing—sprayed metal—has found many applications in the production of electrical and electronic equipment. Originally metallizing was used to provide a soldering base on non-metallic materials in components such as resistors, capacitors and meter faces. Today, its use has spread to applications in shielding, the production of other types of electrically reflective surfaces and in the replacement of wired circuits.

FREE

We have prepared a bulletin which illustrates and describes a wide range of these applications. It also provides engineering data on bond strength on metallic and non-metallic materials, conductivity characteristics, permissible coating thicknesses, circuit tests, as well as a description of surface preparation and spraying methods. A copy of Bulletin 120 "Sprayed Metal Coatings," will be sent on request without charge.

METCO

Metallizing Engineering Co., Inc.

Westbury, L. I., N. Y. • Great Britain: Chobham near Woking

1169 Prospect Avenue
Westbury, Long Island, New York

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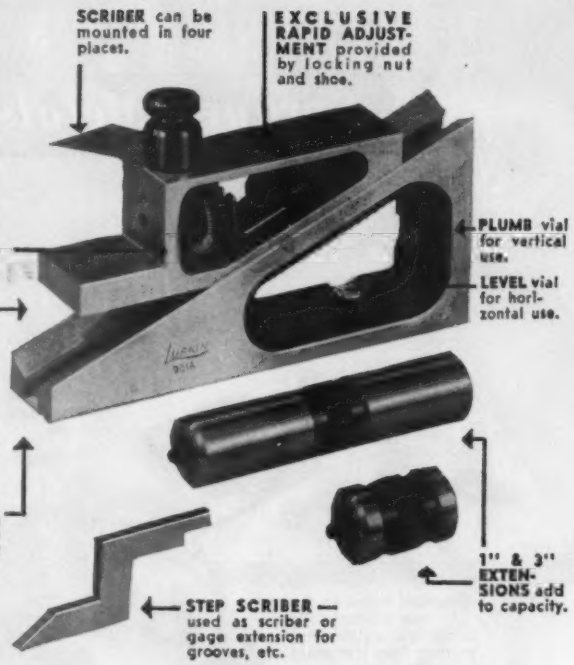
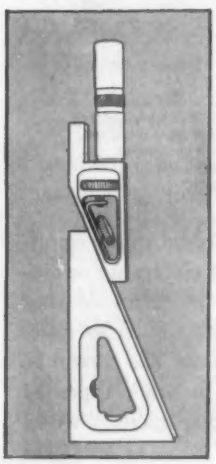
CITY ZONE STATE

NEW
LUFKIN
1" WIDE
MASTER
PLANER GAGES


SCRIBER can be mounted in four places.
EXCLUSIVE RAPID ADJUSTMENT provided by locking nut and shoe.
PLUMB vial for vertical use.
LEVEL vial for horizontal use.
FINE ADJUSTMENT screw for exact positioning.
FULL 1" SQUARE STEP takes standard gage blocks.
MACHINED V WAYS eliminate side play.
1" WIDE BASE gives added stability. Slide undersize to permit easy positioning when gage is on side.
1" & 3" EXTENSIONS add to capacity.
STEP SCRIBER — used as scriber or gage extension for grooves, etc.

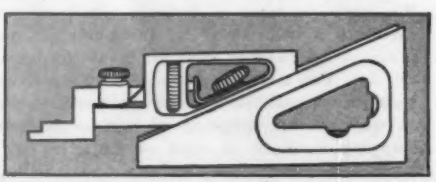


New Design Provides More Stability, Faster Operation

The all-new design of the Lufkin 901A Master Planer Gage is loaded with features you'll like. Note the more stable 1" wide base, the fine adjustment screw, the exclusive rapid adjustment lock, the exclusive plumb level and the many other features shown above. Ask your Industrial Distributor to bring one around so you can try it for yourself. It's available as pictured above, or in other models without certain accessories or features.

with 3" extension in use to extend capacity.

with offset attachment . . . used for setting in narrow places or reversed and used as a scriber.



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THE LUFKIN RULE CO., SAGINAW, MICH.

384

SAVE UNCERTAINTY . . .

Consult Your Industrial Distributor

• He has the answers to "Where can I get it?" at his fingertips — often from stock for immediate delivery.

• His experience gives him a sure answer to your question, "Is this the best solution to my particular problem?"

company—its earnings, or losses, the capital outlay, and proposed extensions of the plant. I'd have these publications mailed direct to the employees—this gives it the personal touch which any man appreciates.

In cementing sound relationship one may well consider the danger of unfounded rumors of a very minor nature, and if there is no breeze of mistrust to fan the fire of dissatisfaction the embers will soon die out.

Frank Van Horn
Auburn, Calif

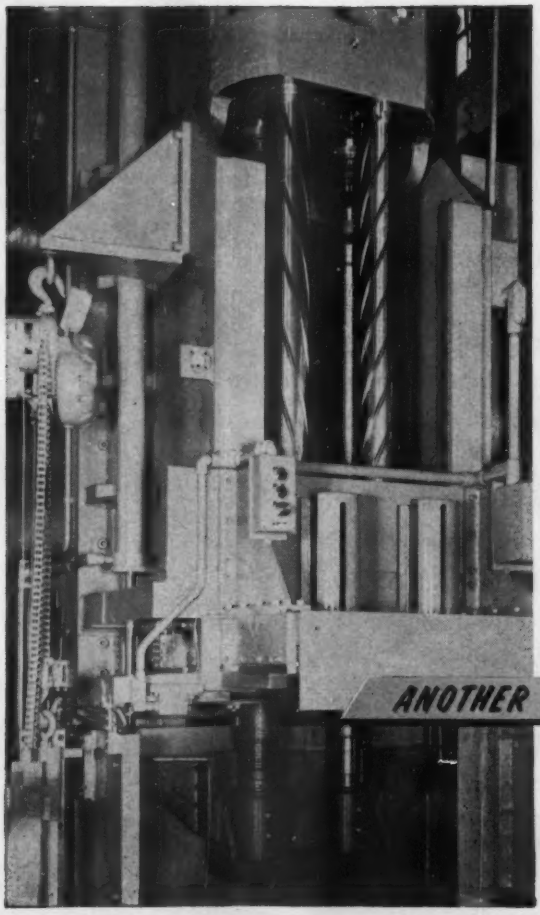
ED HAS the right idea about the rumor board innovation. Any attempts on the company's part to *explain* what a rumor is about is simply putting the company in a defensive position and in this case any Tom, Dick, or Harry could, at most any time, start some outlandish rumor and then sit back and enjoy the company's frantic efforts to explain it away. No important company should permit itself to get into a position where it has to explain to everyone the official opinion of all the rumors that invariably circulate among the employees at all plants. Furthermore, the explanation is almost sure to start a second set of rumors which will invite the company to again explain or refute the second growth—and so on.

One company, I know of, handles this in a very satisfactory manner. No attention whatever is paid to small ordinary rumors that fly around for a few days and then die, but when there is something like: "One of the big shot's secretaries told a boy friend of hers in the design section that within six months the die department is going to be shut down tight and all the WORK farmed out, so you guys better start watching the help-wanted ads," then the

(Continued on page 208)

"I like your looks, Binks. You're hired!"

QUALITY GEARS for QUIET TRANSMISSIONS



...broached automatically

Producing quality internal helical gear teeth is the task of two Colonial 2-station RUF-50-72 pull-up broaching machines. All gears are automatically loaded from cartridges and automatically unloaded, with the larger diameter gears being broached two at a time on each station. These quiet transmission gears with three different leads and diameters, have two left hand and one right hand spiral. All three different gears may be broached as production demands on either of the two stations.

Broaches are guided on both ends through full length of cut; broach handling is automatic with safety interlock. Colonial broaches for these gears weigh as much as 800 pounds, and are 81 inches long. Broaches return through a retractable brush and a pressure spray washes chips away. An electric hoist mounted on a universal loading arm handles these broaches in and out of the machine. A cooler for cutting oil, a magnetic chip separator, and an automatic chip conveyor are also furnished on these two Colonial pull-ups.

ANOTHER EXAMPLE OF COLONIAL UNIFIED BROACHING

COLONIAL BROACH & MACHINE CO.
DETROIT 13, MICH.

The Man who didn't

until he finished that job for you...

First things *first* . . . that's how your Simonds Distributor looks at it. *Your* interests first . . . and then there's time enough for other things. We know . . . because he tells *us* when he would never tell *you*.

Chances are your success was built the same way. And when you get right down to it, how many really successful businesses are built *any other way?*

We are proud of our many years of close association with our distributors. No one values a customer more than we. And our distributors are the same stripe . . . educated to service and dedicated to the simple idea of *staying with the customer* in time of trouble until the job is licked and the last Simonds red-trade-marked tool is cutting the way the factory made it to cut.

This is still a family business . . . and our distributors will always be a vital part of this family. Now, if you're the same sort of folks, we will be most happy, any time, to show you exactly what we mean by *real* "family feeling" in industry.

For Fast Service from Complete Stocks

Call your **SIMONDS Industrial Supply DISTRIBUTOR**

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

come to dinner...
SIMONDS
SAW AND STEEL CO.

Built into your equipment

BIJUR

AUTOMATIC LUBRICATION ASSURES SATISFACTION

you benefit 5 ways

- Increase Production Capacity
- Save on Repair Bills
- Eliminate Costly Hand Oiling
- Reduce Downtime
- Lengthen Machine Life

WITH Bijur Automatic Lubrication as an integral part of your machines, you benefit from continuous peak production. Plant after plant reports increased out-put and greatly reduced maintenance costs with Bijur-equipped machines. Costly downtime for lubricating by hand is eliminated. Every bearing is metered the proper quantity of oil at predetermined intervals. Work spoilage and bearing troubles caused by over-lubrication are avoided. Fire hazards are reduced. Personnel accidents are prevented.

More than a million Bijur-protected machines are currently in use. Hundreds of leading manufacturers standardize on Bijur as "built-in" components of their machines. Bijur emphasizes custom engineering, and will gladly cooperate with your machine builder in designing a lubricating system to meet the specific requirements of the machines you order.

Bijur designed into your machines now automatically assures satisfaction. It makes sense . . . and dollars, too! Why not write today for literature and engineering information?

P-2

1843

BIJUR
LUBRICATING CORPORATION
Rochelle Park, New Jersey

Pioneers in Automatic Lubrication

superintendent mentions to the various foremen that he has heard some wild talk about the die department shutting down, probably started by some sorehead. The facts, if anyone wants to know, are that the die department is expected to continue in full operation and, furthermore, there has been some tentative plans that it may later be moved into a larger and more modern new building, that is, if business keeps improving. This may be the basis of the irresponsible "shutting-down" talk. It is surprising how quickly the rumor is scotched by these few, off-hand remarks by the superintendent. On the other hand, if some changes in operations are being discussed, or some departments are to be merged, and it has passed the consideration stage, then the superintendent explains the possibility to his foremen who soon get the facts straight to the involved departments—and so on.

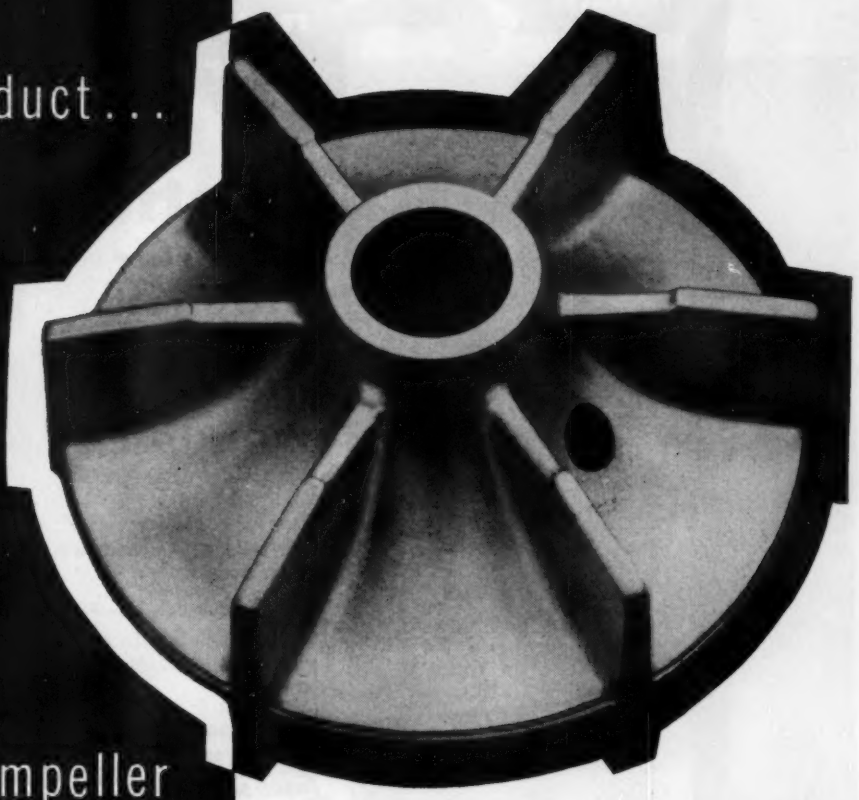
It is much better to have the employees in a department aware of probable changes in operations, so when it finally arrives there is no unexpected shock, mental worry, and confusion. Furthermore, if the employees realize that the company has always kept them correctly informed on matters pertaining to their welfare and always sees to it that they get full and sympathetic consideration, then the company does not have to worry very much about rumors.

George P Pearce
Albuquerque, NM

WHEREVER there happens to be a group of people working together, by the very nature of things, inevitably there will be found the gos-

"—You got one thing to be proud of. No other candidate for Steward ever lost by such a big vote as you!"

another case where
MUELLER BRASS CO.
FORGINGS
improve a product...



diesel engine
water pump impeller
forged of **"603" HIGH STRENGTH BRONZE**

Formerly produced as sand castings, these impellers now give better results because they're forged from "603" high strength bronze by the Mueller Brass Co. Said to be "right for the job and far superior to the old cast impellers", these forgings bring greater efficiency and longer life to the diesel engine water pumps in which they are installed. This tough "600" series alloy is readily forgeable, possesses remarkable resistance to corrosion, and has fine bearing qualities. Uniformity is excellent, due to the closer dimensional control of the forging process, and surface finish is noticeably smoother. This is another case where Mueller Brass Co. forgings have greatly improved a product . . . why not let our engineers show you the many advantages of using forgings.

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MUELLER BRASS CO.

PORT HURON 23, MICHIGAN

TECHNICAL Lusol
TECHNICAL Lusol
TECHNICAL Lusol K-7
TECHNICAL Lusol shamrock
TECHNICAL Lusol Unikool
TECHNICAL Lusol MACHINE CLEANER
TECHNICAL Lusol G-3 GERMICIDE
TECHNICAL Lusol TAPCOOL
Lusol
now offers
eight
superior products to improve metal working
Lusol
Finest water-soluble coolant for high-speed work — especially with carbide tools.
Lusol Super-Concentrate
Double-strength Lusol for minimum storage and handling.
Lusol K-7
The ideal transparent solution for all grinding operations.
Lusol Shamrock
An excellent combination of cooling and lubrication.
Lusol Unikool
A high-quality, low-cost universal coolant and lubricant.
Lusol Machine Cleaner
Cleans machines of all dirt, gum, fatty materials, etc.
Lusol G-3 Germicide
An efficient method of ridding machines of bacteria.
Lusol Tapcool
A series of threading and tapping compounds.
TECHNICAL BULLETINS ON REQUEST
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Lusol
BETTER PRODUCTS FOR BETTER METAL WORKING
7A055A

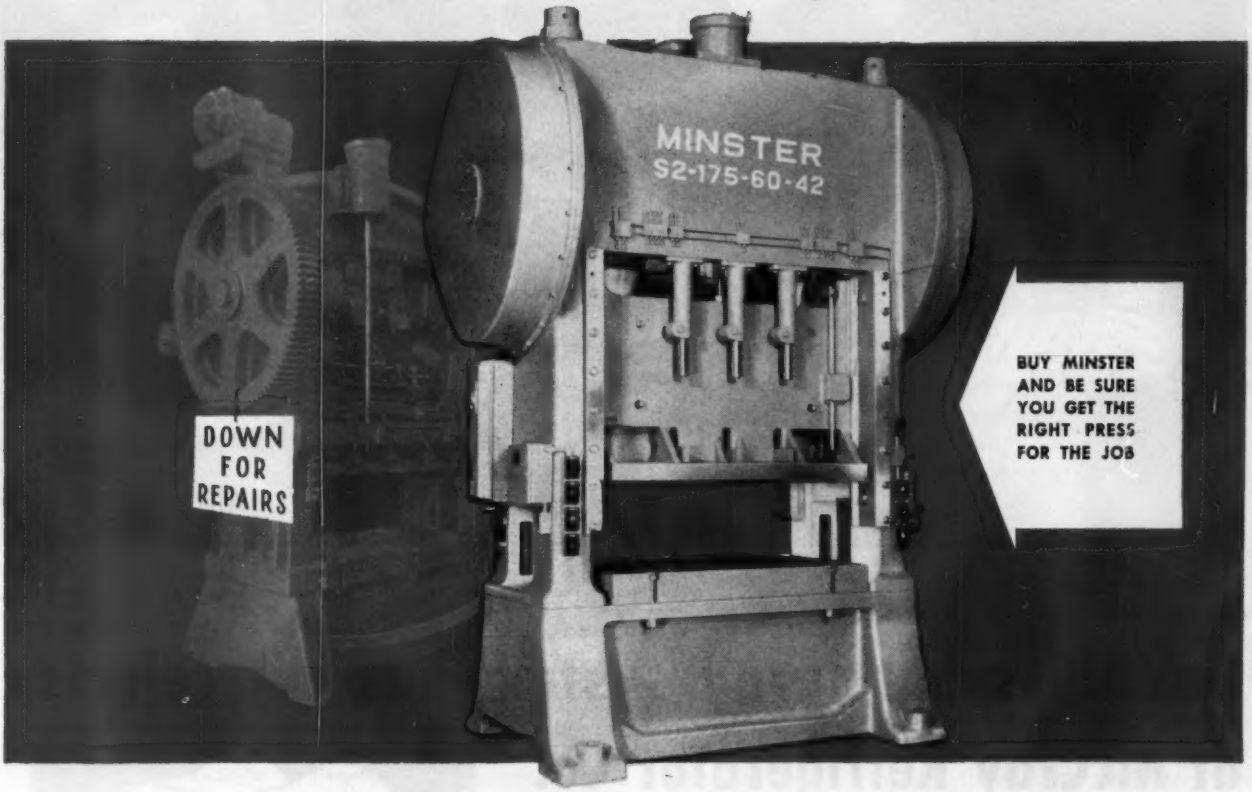
sip—male or female. He or she may be the malicious or the harmless type, depending on the nature of the individual. Unfortunately, also, in every group there are individuals gullible enough to believe any rumor that is put in circulation without making an effort to find out if it has any foundation in truth. If the company is involved, an unscotched rumor can seriously impair morale and do considerable damage. I have in mind an incident that illustrates what can happen when a rumor gets out of hand.

The president of a concern employing several hundred workers happens to be a devotee of hunting and fishing, and, with several other kindred spirits, decided to form a club. One of the members found out about a hunting preserve in Maine that happened to be on the market, some hundred acres in extent, along with a clubhouse, and the company president, who was also the club president was empowered to negotiate for the land. Some of the correspondence with the real estate firm who had the land for sale was handled in the company office and someone got the wrong idea, with the result that the rumor got around that the company was moving to Maine. As this concern happened to be the only industry in town of any consequence, with most of the inhabitants depending upon it for their livelihood, the economic effect of such a move would have posed a serious problem for the town—had it been true. Solid citizens don't relish the idea of facing the prospect of taking up their roots and moving to new territory two or three hundred miles away in order to earn a living. To add to the confusion, the president left on a business trip before the rumor got back to him and was gone for over a week, with the result that the rumor snowballed to fantastic proportions.

Finally, the plant department

"And another thing, if you hire me, you won't have to worry about my running out for coffee all the time."

A Minster Press means
LESS DOWNTIME



Here is why Minster Presses on the job mean more production hours and less downtime for press repair!

1 ADVANCED DESIGN to give you the value of the best practices and latest improvements in presses . . . Box type construction for less deflection and better bearing support . . . Slides having longer ways fully supported and widely spaced . . . Large diameter connection screws . . . Method of taking up wear in lower connection bushings . . . Barrel slide adjustment on all sizes over 60 ton.
Clutch controls, both air and electrical, to improve press operation and production methods.

2 MINSTER'S PATENTED COMBINATION FRICTION CLUTCH AND BRAKE . . . One single automatically synchronized unit having air engaged multiple disc clutch and spring applied brake . . . Fast controlled engagement or disengagement at any point on 360° surfaces . . . Shock absorbing action . . . Exceptional friction surface life. *No more sledge hammer engagement, fast wearing and hard to fit replacement parts.*

3 PRECISION FITTING where it counts . . . Ways scraped to master gauges and square to the slide face . . . Bed scraped to surface plate . . . Bearing bores and bushings honed to fit . . . Ground spacers for maintaining proper gib clearance . . . Ground and roll burnished crankshafts.

4 MAINTENANCE INFORMATION AND OPERATOR INSTRUCTION applying to your press . . . A guide to preventive maintenance and operator training.

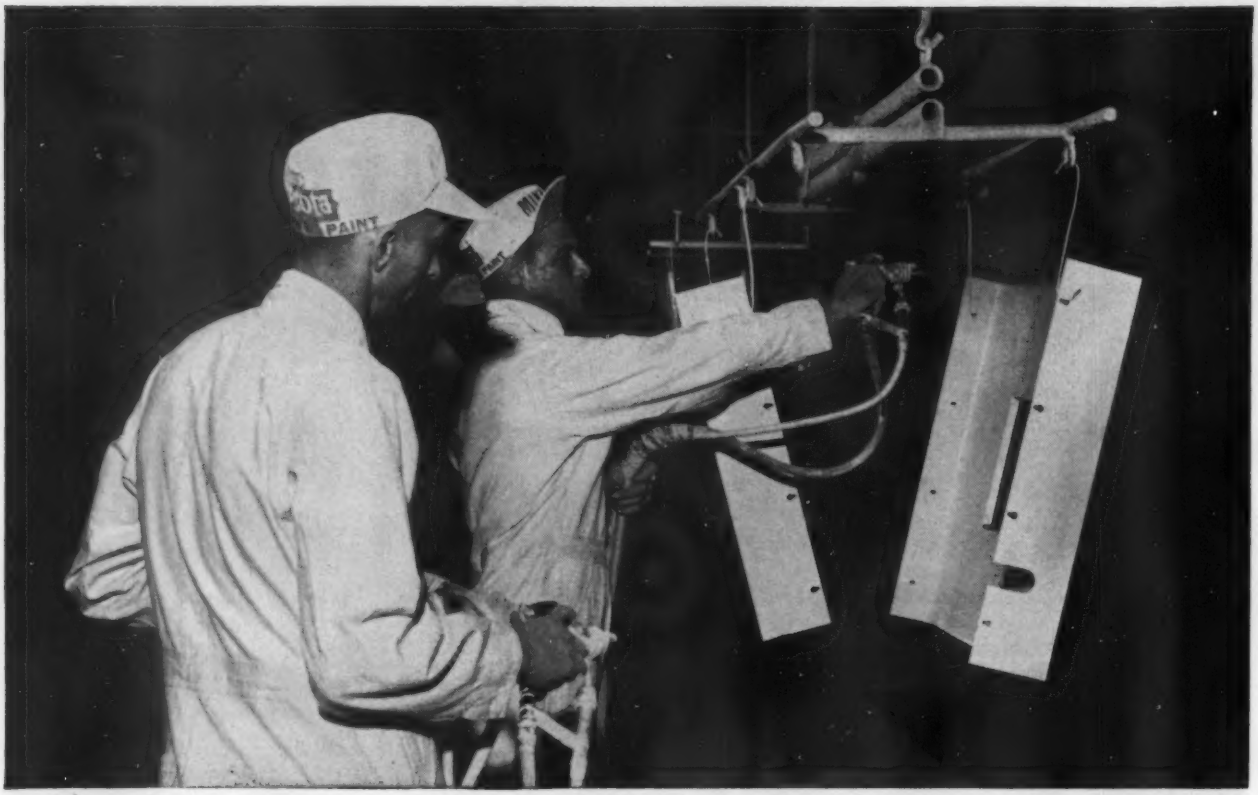
Let Minster help you plan your press replacement program

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

PRESSES



McCray paint-line operators like the DeVilbiss system because it makes the paint spray the same, cover the same regardless of room temperature or weather conditions.

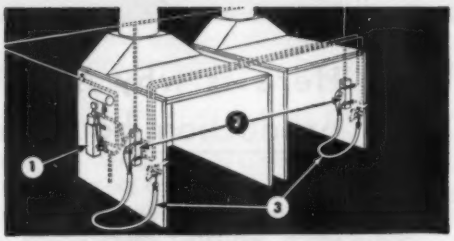
DeVilbiss hot-spray system has cut rejects at McCray Refrigerator Co.

Familiar problem: Rejects had been slowing production and causing costly refinishing at the McCray Refrigerator Company, Kendallville, Indiana. The hot-spray equipment McCray had been using failed to maintain the precise pressure, temperature, and viscosity control necessary in the application of enamel paint.

Cost-saving solution: McCray took its problem to DeVilbiss. The result: DeVilbiss' hot-spray system has cut rejects; reduced air and fluid pressures; and keeps temperature and viscosity constant, providing flawless coverage. Production, now running a full 8-hour day without a break, has increased.

Because of accurate temperature control *right up to the gun,* McCray has realized big savings. Less solvent is used in the paint. What's more, the simple operation of the DeVilbiss system has made the enameling job easier; cut maintenance costs substantially.

What to do: Let a DeVilbiss representative show you how *you* can improve your finishing operations. The standard components of DeVilbiss' paint-heating system can be combined in countless ways . . . to meet your special needs.



DeVilbiss hot-spray system is foolproof; adapts to multiple gun hook-ups. Hot water from master heater (1) heats paint in exchangers (2); heat-jacketed hose assemblies (3) keep paint hot right up to guns, assuring uniform viscosity at all times at each gun.

THE DEVILBISS COMPANY
Toledo, Ohio
Santa Clara, Calif. • Barrie, Ontario
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DEVILBISS

SPRAY GUNS • AIR COMPRESSORS • HOSE AND HOSE CONNECTIONS • TRANSFORMERS • SPRAY BOOTHS • ACCESSORIES

heads got together and, with the superintendent, sent the president a wire regarding the situation. He returned immediately, of course, and promptly clarified the situation, and both the plant and the town returned to normalcy. But there was a very definite production lag while the rumor was in circulation, because people do not concentrate fully on what they are doing when they have a serious problem on their mind.

While I don't believe it necessary to go to extremes in keeping workers informed about every move the company makes, any rumor that makes for poor employer-employee relations should be promptly investigated and dealt with. The foreman's part in good employee relations cannot be minimized. Keep him informed, and he in turn can deal with the rumor-monger.

Robert S Alexander
Glastonbury, Conn

MOST WORKERS are interested in two factors. First, is the job that they hold stable? Is it going to be there for a long period of time or is it, due to company instability, to be discontinued shortly?

The second factor workers are interested in is the pay they receive for the work they do. It must be as high as anywhere else for the same labor expended, and it must be forthcoming each week without any hitches.

When labor has these two ingredients from a company, the workers are little concerned with rumors. Naturally all companies have troublemakers who love to see things in a continual uproar. Many times these individuals are not in the worker class, but are in the higher level of management. Stories are started in order to impress other people with their knowledge of important phases of company operations.

Too often these stories have no foundation and are strictly figments of the imagination. Human nature being what it is, there is always a listening and believing public. A rumor started will not always fall on deaf ears, but if the story has no foundation, and there is not a weak link in the relationship between management and labor, the rumor will die.

It is far better to have a company-labor relationship that does not allow foundation for rumors than to try to put out a fire after it is started by the use of a rumor board.

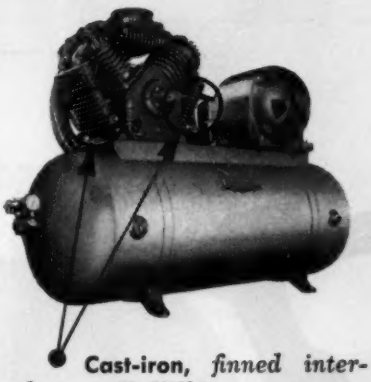
Many people who would not dream of thinking in terms of the truth of a rumor would suddenly become suspicious of facts when the company placed on the rumor board the truth of a story. Workers have been schooled for years never to believe company statements; they usually take them as propaganda. So as a company resorts to trying to put out rumor fires, it is creating an inferno which nothing can stop.

Employees are not interested in company internal affairs beyond the points with which we opened this discussion. If rumors are about these two factors, the company is in trouble, and nothing much can be done about it if the rumor has any foundation at all. Too many times rumors are based on some shred of fact, but unless something actually transpires that makes the majority of the workers believe the rumor, then it is far better to let it die without company opinions or statements being expressed.

Naturally, if the rumor had foun-

"The old man will boil us in oil if he finds out about that boner we pulled!"

Cut Compressed Air Costs!



Cast-iron, *finned inter-coolers on DeVilbiss compressor outfits lower the air temperature between the first and second compression stages, and provide extra cooling. Result: much higher efficiency and greater air output.*

The biggest cost in compressed air is the operating cost. DeVilbiss air compressors save on power, upkeep, and depreciation. By actual tests, DeVilbiss air compressors deliver up to 22.6 percent more air per power dollar. In fact, many times they pay for themselves in power savings alone.

In addition to inter-coolers, every DeVilbiss compressor includes these features: automatic pressure switch, A. S. M. E.-approved tank, check valve manifold, diamond-bored pistons, cylinder head with removable valves, quality electric motor or gas engine.

Contact your local DeVilbiss jobber for a complete analysis of your compressed air needs.

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Gulf Products aid

Gulf Soluble Cutting Oil provides high cooling efficiency for this grinding operation on a propeller shaft.

A view of the material control area where the parts are stored in readiness for assembly after immersion in a tank of Gulf No-Rust FPR.

operations at Aerodex, Inc.

The world's most modern aircraft engine overhaul facility

By adapting mass production techniques to engine maintenance in the world's most modern engine overhaul shop at Miami, Fla., Aerodex, Inc. overhauls an engine with fewer man-hours than any other commercial organization. This represents a considerable saving to the Air Force, with whom Aerodex has large contracts, as well as to private concerns which send their engines in for overhaul.

Gulf products are used throughout the Aerodex shop to help speed their engine overhaul work. Gulf Lasupar Cutting Oil helps produce parts to extremely close tolerances with few tool changes in machining operations on many types of steel, while Gulf Soluble Cutting Oil provides high cooling efficiency for grinding operations. After machining, the parts are cleaned in a bath of Gulf Stoddard Solvent, then dipped in a tank of Gulf No-Rust FPR to protect polished metal surfaces against rust during temporary storage. Every engine is fueled and lubricated with Gulf Aviation Gasoline and Aviation Oil during the 3¾ hour test run after final assembly. And various other Gulf Quality Products help keep the auxiliary equipment required for a large operation of this type working smoothly and continuously.

You too will find, as did Aerodex, that there is a Gulf Product to fit your every need —quality oils and greases that can help you improve production and lower your maintenance costs.

Consult the telephone directory for the number of your nearest Gulf office, then contact a Gulf Sales Engineer for help on any problem that involves a petroleum product.

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

All engine parts are reworked, inspected and then sent to the material "hold" area, where they are immersed in Gulf No-Rust FPR. This quality rust preventive cleans the finely machined surfaces and protects them from rust during temporary storage.

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GULF REFINING COMPANY

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GULF

SHELDON
CHICAGO U.S.A.

NEW Sebastian 13" A-5 GEARED HEAD PRECISION LATHE

Available in 5 ft., 6 ft. and 8 ft. bed lengths. Also, SHELDON - Sebastian 15" No. B-5 Geared Head precision lathe.

This is a completely new Sebastian Lathe *designed and built by Sheldon* . . . a rugged work horse with extra power, toolroom accuracy and all the modern features that make for money-saving production . . . with all controls centrally grouped in easy reach for safe efficient operation.

Modern, heavy cast-iron pedestal (included in base price of lathe) completely encloses motor and drive . . . with storage space in tailstock leg for tools and chucks.

Speed changes easily made by revolving speed dial on headstock

Heavy, multiple Splined Spindle with "Zero Precision" tapered roller bearings

Quick change Gear box provides 60 different threads or feeds — has built-in lead screw reverse

Massive 1-piece, double walled apron with gears running in oil has "1-shot" pressure lubrication system for carriage and ways

Cam action tailstock clamp permits rapid release and instant locking of tailstock

Run this new Sebastian lathe. Test its performance. You will appreciate the powerful cuts that this lathe can take.

Write for circulars on 13" and 15" Sebastian lathes and name of nearest dealer where you can see and operate these outstanding lathes.

SHELDON MACHINE CO., Inc.

Builder of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes

NORTH KNOX AVENUE • CHICAGO 41, ILLINOIS

dations, it would be better for the company to make a statement, and a true statement, of facts concerning its stability and its wage plan, thus putting at rest the minds of the ordinary wage earner. The rest of the situation will take care of itself.

Remember that workers are not as interested in all company activity as are members of the staff and foremen. We must always remember that point in any discussion regarding company actions. It is up to the foremen or supervisors to help stop rumors, and never to start them for the mere pleasure of appearing to be a big shot.

Don't be a rumor peddler, and you won't need a rumor board.

Charles D Townsend
West Hartford, Conn

•

DON'T PROMOTE ME

Should a man who refuses a promotion be taken at his word, and left in the job he feels suits him? Is this always a sign of lack of self-confidence, or can it be merely a knowledge of his own capabilities?

FOREMAN AL has lost complete sight of the old, tried and true industrial adage "A good mechanic oft-times makes a lousy foreman." One of the major problems today in industry is the mediocre calibre of its foremen. It's my guess that Foreman Al is one of the "knotheads" he cites in his closing statement.

Al also forgets or perhaps is unaware that the vast majority of top and middle management today is composed of men who have broad and well-rounded, rather than specialist, skills. Complete and exclusive

"—I tied the knot to remind you there's work to be done!"

REYNOLDS ALUMINUM
ENGINEERING SERVICE

How Reynolds can help you work Aluminum better

To improve production with aluminum only small changes in fabrication methods and procedures are required. In making changes in welding, forming, casting, forging, machining, finishing, assembling with this light, strong, rustproof, versatile metal, call on Engineering Services.

The engineers and technicians in these Reynolds departments know aluminum. They know how standard machinery and equipment can be simply adjusted to aluminum's requirements. Their expert knowledge of aluminum will help you work aluminum most efficiently...make your products better and more profitable.

You can have the aluminum know-how of Reynolds engineers and technicians in book form, too. On the opposite side of this page is a complete listing of Reynolds Handbooks, invaluable aids in getting more from aluminum.

Reynolds Engineering Services are available through the Reynolds Metals office near you listed under "Aluminum" in your classified telephone directory, or write direct to Reynolds Metals Company, P. O. Box 1800-JU, Louisville 1, Kentucky.

REYNOLDS ALUMINUM
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A LIBRARY OF HANDBOOKS filled with important and useful information on aluminum design and fabrication. If your job is management, design or production, these books can be vital to you. Single copies of any or all of these are yours without cost when requested on your business letterhead.

ALUMINUM DATA BOOK—160 tables give complete physical, chemical and mechanical properties; availability data, tolerances, definitions, fabrication information . . . 220 pages.

DESIGNING WITH ALUMINUM EXTRUSIONS—Explains the basic principles for using extruded aluminum shapes most effectively . . . 138 pages.

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16mm Sound-Color Films Available, too

1. **SHAPE OF THINGS TO COME** (extrusion design and application)
2. **TALE OF THE POWDERED PIG** (powders and pastes and their uses)
3. **PIGS AND PROGRESS** (aluminum from mine to finished products)

A COMPLETE INDEX

of all Reynolds Technical Literature and Films on aluminum design and fabrication is also available. Write to Reynolds Metals Company, P. O. Box 1800-JU, Louisville 1, Kentucky.

Instructors in technical schools are also invited to take advantage of these educational aids. Write for details.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

knowledge of any single phase or operation of an enterprise is a bar, rather than a stepping stone to promotion.

The criteria used to select management personnel are constantly being improved. However, results are inevitably poor when the main consideration is merely past performance.

I would gamble that almost any really successful man in the capacity of foreman, or higher, today can point to many, many individuals he has passed on the way up—persons who have better actual skills than he has in the work they are doing, persons who have been in the business longer and, in lots of cases, persons who have even a more burning ambition to progress. But the favored individual is the one who can balance, manipulate and evaluate the various forces that make a business tick.

In conclusion, and to be more specific, I would recommend that Al's judgment of his "knotheads" be reviewed. If he is correct, then an outsider should be brought in as group leader. Under no circumstances should the 'Joe' who is perfectly content with his niche be kicked out of the nest.

John C Sears
Washington, D C

I THINK that one who is in line for a promotion must have a good reason for refusing the job. His mind must be logical in his reasoning, or his work would not be such as to give him preferential rating for a job, which ordinarily is considered "better." Thus when this situation is encountered, and superficial conjectures arise that the man under consideration wants to be "safe," or that he is afraid to advance, further study of his case should be made by a person who understands human nature and can analyze human motives.

Excuses such as these hardly seem adequate. Does not safety (freedom of fear from lay-off), and security (economic) increase with advancement? We are led to believe this.

When someone is encountered who refuses a promotion, against the wishes of his superiors, it should be ascertained whether he has been willing to assume some responsibility other times, and the extent thereof.

I would like to suggest that anyone who refuses a promotion in spite of the insistent subtle pressure of success stories broadcast

(Continued on page 220)

Marshall-Richards vertical inverted tube blocks in operation for 2 years at Yorkshire Copper Works Ltd., Leeds, England. Typical drawing cycle, from 1.875″ o.d. and .094″ wall thickness to .322″ o.d. and .028″ wall thickness, in 8 passes. Drawing speeds from 225 to 2,025 fpm available.

An Addition . . . That Multiplies Our Ability To Serve You

Fenn will now build and sell, on this side of the Atlantic, the outstanding wire and tube drawing machines of Marshall-Richards Machine Company, Ltd., of England.

You can now meet your every wire and tube fabricating need from one source, because these machines perfectly supplement Fenn's wire shaping mills, rolling mills, Turks Heads and swaging machines.

The Fenn Manufacturing Company

759 Fenn Road,
Newington, Connecticut

•

Wire Shaping Mills
Precision Rolling Mills
Turks Heads
Swaging Machines

FENN

DON'T BE "SOLD"...

...GET THE FACTS

MAKE about

HERE'S HOW USERS HAVE "MADE UP THEIR MINDS"

R. H. Plourde, N. E. Die Co., Waterbury, Conn.:

"Excellent for its power and precision. We intend to standardize on Delta."

E. J. Coats, owner of Pine Grove Mfg. Co., Ripley, Miss.:

"We waited a year to get the Delta Lathe. We certainly wouldn't want to be without it."

R. J. Hood, President of Eastern Tool Co., Hartford, Conn.:

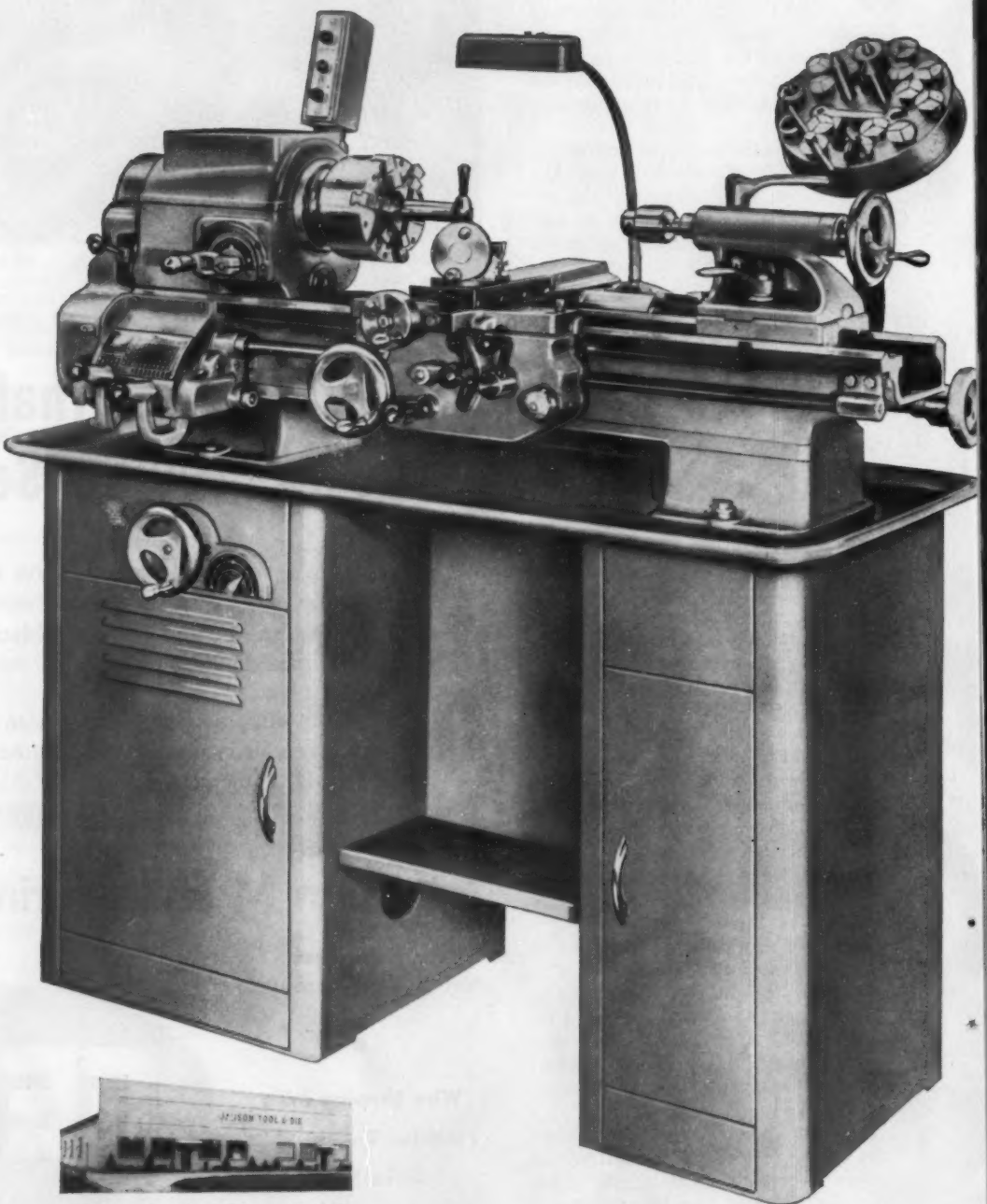
"Extremely rugged even compared to costlier lathes. Simple changing of speeds and drives saves us money every day."

D. Hart, Sales Manager of Carros & Hart, Bristol, Conn.:

"It's the best lathe of its type. It makes heavier cuts faster than some other more costly lathes available."

J. A. Stupian, President of Ordnance Specialties, Inc., El Monte, Calif.:

"We chose Delta because of the need for a rugged, yet precision, lathe. Not only is the new Delta lathe capable of outstanding performance, but it is also very economical."



A. Janson, President of Janson Tool & Die Co., Toledo, Ohio: "It's rugged and accurate. We can recommend it to anyone."

DELTA QUALITY COSTS NO MORE

UP YOUR OWN MIND
the Metal Lathe best for you

Here Are The Facts About The Great NEW Rockwell-built DELTA 11" Metal Cutting Lathe...

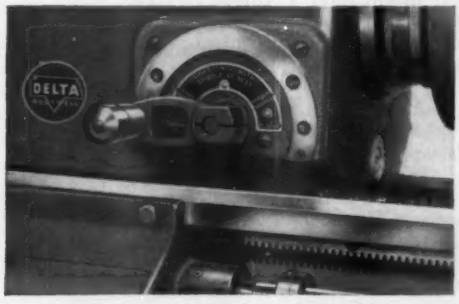
ACCEPTED THROUGHOUT INDUSTRY
It's a fact! This great new Delta 11" Metal Cutting Lathe has—*in less than one year*—gained tremendous acceptance throughout industry. Users in the largest industrial plants and the smallest tool room shops all agree that it's the finest 11" metal cutting lathe on the market!

MORE QUALITY FEATURES AT LESS COST
It's a fact! No other 11" metal lathe, *regardless of price*, combines all of the precision, safety, and convenience features—all of the built-in Delta Quality "extras"—that you'll find in this great new Delta Lathe. Delta, the pioneer power tool maker, has put all of its unsurpassed experience into this lathe—power tool design and manufacturing experience that makes possible the highest quality at the lowest cost!

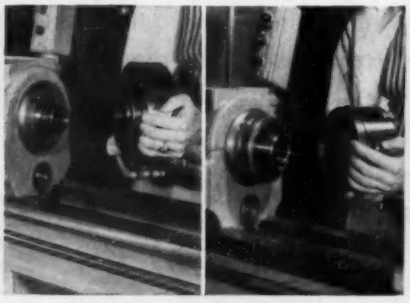
REPLACING HIGH PRICE LATHES
It's a fact! This versatile Delta 11" Metal Cutting Lathe is replacing lathes costing far more. That's because more than five years of intensive research, development and testing went into its making to give you greater *precision* for the closest tolerances combined with extra *ruggedness* for lasting accuracy under tough shop conditions.

GET ALL THE FACTS—THEN COMPARE
See this great new Delta Lathe in operation—try it yourself! Then compare it with any other lathe of comparable size—and MAKE UP YOUR OWN MIND! Let your Delta Dealer demonstrate—he's listed under "TOOLS" in the classified pages of your phone book. And be sure to send the coupon for complete catalog information—today!

Compare These EXCLUSIVE DELTA Built-in Quality Features...



EXCLUSIVE DRIVE SELECTOR
Only Delta lets you select every drive position—loose spindle, locked spindle, direct drive or gear drive—simply by moving one lever.



CHOICE OF SPINDLE NOSES
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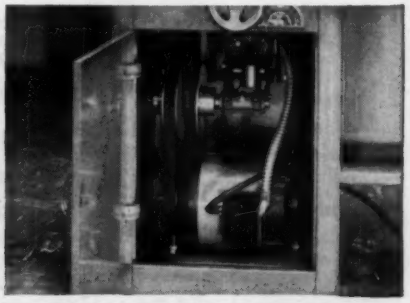

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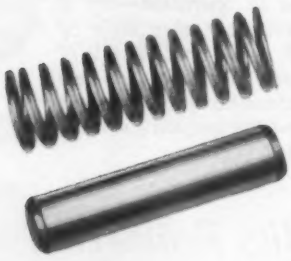
And, remember, our stock die sets are shipped within 24 hours; specials in remarkably short time.



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through the media of radio, television, and the press, which tend to make one aspire to success, and in spite of economic pressures, then he either lacks confidence in himself, or is deliberately refusing so that he can hurt himself, so that then he can feel sorry for himself more acutely. It takes someone who has felt this to understand it, or a psychologist.

Edward Diskavich
Torrington, Conn

THE SCIENCE of handling human beings has no set rules. In spite of all the research, both theoretical and practical, each man is an individual character. He performs his task and does his own thinking regardless of patterns, standards, and procedures. Other men will follow him or ignore him, depending upon their individual characteristics. When promotions are in order, some men will rush forward, others will wait to be asked, and others have to be pushed. Many think they have the qualifications, some don't know if they have but are willing to find out, others don't know and don't care.

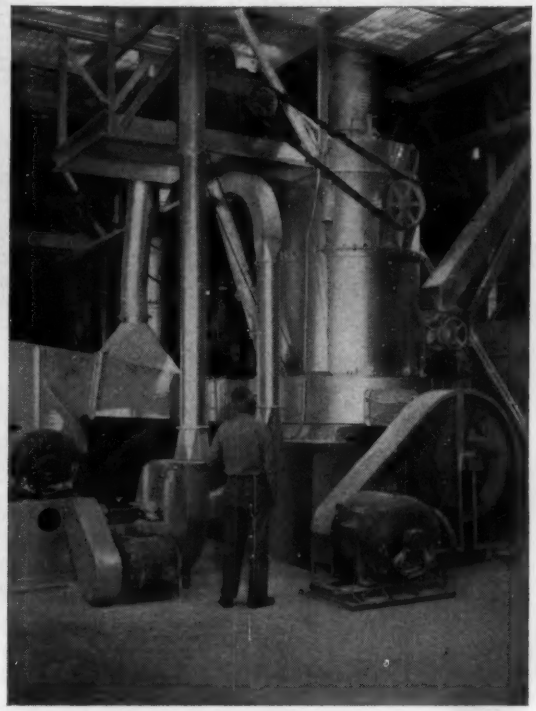
A psychological or aptitude test might indicate a man is a leader and then he will turn out to be a complete disappointment. A man with a low IQ sometimes turns out to be a born leader.

Education is not the sole yardstick. Since many presidents and leaders never finished high school, but a porter working in the shop might have a college degree.

Gaging a man's capacity is still a trial-and-error estimate, and the man who considers himself a judge of men is an ignorant lout with a good guessing average.

If a man either by seniority or

"Nice to have you over evenings. I enjoy talking about the plant."



• Big pulverizing mills made by Raymond Division, Combustion Engineering, Inc., depend on Johnson Bronze Bearings for trouble-free performance the world over. At right is a high side roller mill installed in the Kaiser Gypsum Wallboard Plant at Seattle.

Where One Bearing Can Keep Whole Plant From Shutdown

When you're investing up to $85,000 for a pulverizing mill around which you're going to build an entire plant, you expect to get equipment which will give long, trouble-free performance.

One leading company in the field of designing and manufacturing pulverizing mills for use all over the world makes every effort to do just that—build sturdy equipment of the best available materials which won't break down because of the failure of any one part.

Because bearings play such an essential role in the operation of pulverizing mills, the Raymond Division, Combustion Engineering, Inc., has relied for more than 30 years on cast bronze bearings made by the Johnson Bronze Company of New Castle, Pa.

Johnson Bronze bearings rate high with this Chicago manufacturer because they can be depended upon to keep these expensive units on the job day in and day out and because they are made just the way Raymond Division specifies. That means a very low rejection rate and faster production.

Take the big bronze bearings Johnson makes for journals on a pulverizing mill. They are made to a tolerance of .002 of an inch. Because Johnson consistently meets this specification, the time required to fit the bearing is held to a minimum. A few taps with a rawhide mallet usually slips the bearing into its position.

If your product demands uniformity, investigate Johnson Bronze products. You can depend on them for faster production and longer life in use. Skilled engineers are available to help you decide what type of bearing you need to get the best possible results at lowest cost. Johnson Bronze Company, 515 S. Mill Street, New Castle, Pa.

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sentiment is eligible for a promotion and hesitates to accept the position, he should be forced to step up. If the man is a good mechanic and is not interested in the promotion, he should be permitted to stay at his present position since it is easier to break in a foreman than pick up a good mechanic.

Only in an emergency is it necessary to rush out and find a foreman. Each shop should always have likely prospects who are being developed to step up when the occasion arises.

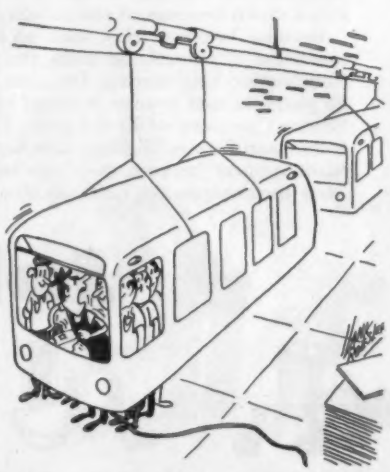
Frank J Zarnowski
Rutherford, NJ

THE CASE UNDER CONSIDERATION is what to do with a man named Joe Adams, who happens to be the victim selected by a foreman as being the best available man to promote to the new job of gang leader and tool setter.

The aforementioned Joe Adams refuses to be promoted (a very unusual situation) on the grounds that he is well satisfied and content in minding his own business, and has no desire to scatter his well trained brain among the business of other men.

Joe has learned much about life through his own experience and observation, and now values his daily contentment in doing his own kind of work much more than being promoted. He has great confidence in himself as a skilled workman, and takes pride in turning out first-class jobs. Whatever inducement the new job may offer, it means little or nothing when compared to his peace of mind.

A foreman with a good background



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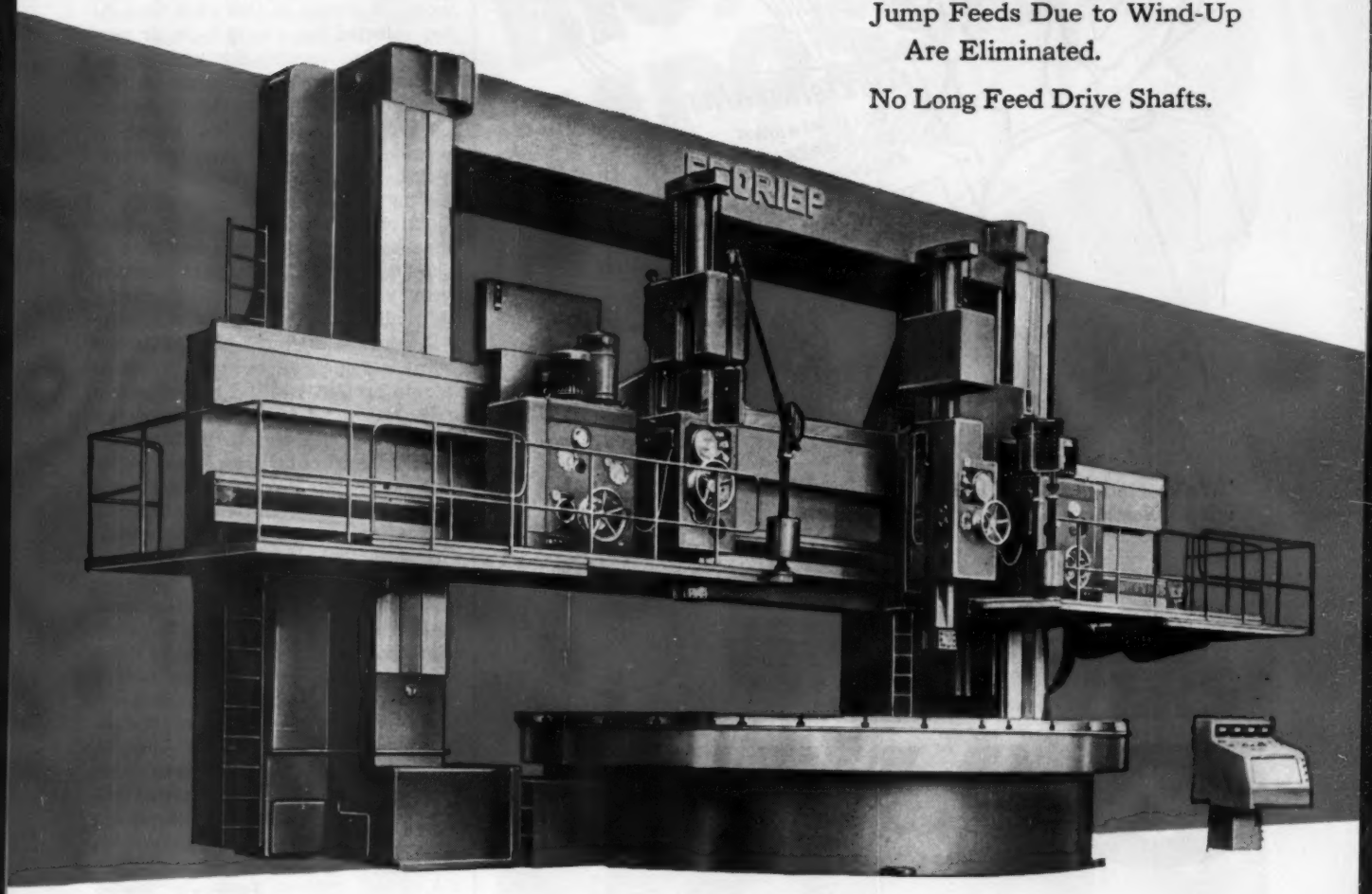
Electrical Feed Transmission.

Jump Feeds Due to Wind-Up Are Eliminated.

No Long Feed Drive Shafts.



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Speed ratios: 1:100.

Speeds can be changed during cut—automatically, if desired.

Fully electrically controlled.

Special attention has been given to pressure lubrication of table bearing.

Thermal elements are provided to indicate undue temperature rise.

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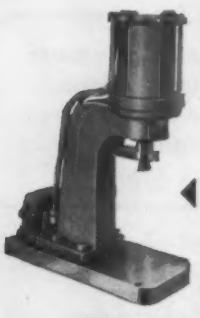
It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.



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6 Tons (Model B-2) One of more than 30 models. Press with base, $554.

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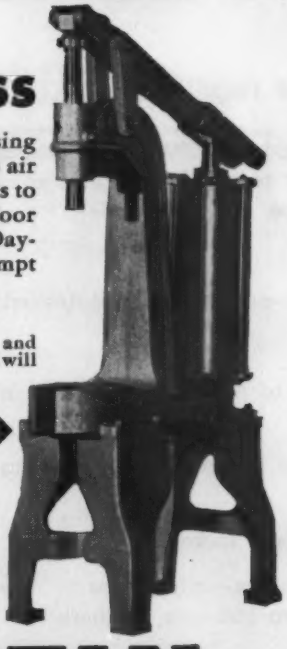
Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



HANNIFIN

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of experience in the business of supervising other men generally has a broad knowledge of different types, and is reasonably able to select the right person for certain kinds of work. It seems in this case that Al has selected the wrong type, or perhaps he has another motive in mind. It may be a political move on Al's part to reduce the prestige of Adams by putting him on a job where he would not get the publicity he acquires by turning out nice work in his own little corner.

Al claims that Adams is the only man suitable for the job, and that he should be made to accept it (another very unusual situation). Of course, Al really has no intentions of forcing the issue, because if he did he knows there is some possibility that Adams would promptly quit. Then of course Al's own prestige would drop down a few notches, and his department would be in one hell of a fix. Why not let Adams alone? He is a good asset to the firm, and knows his own limitations better than anyone else.

Unless the available job is a highly technical one it is most advisable to keep the promoting business within the department. We must consider that the men working there are more familiar with the nature of the work. It is an experiment, true, but has often proven not so costly as when the job is given to an outsider. It often happens that when a man is not considered too good at one job he may turn out to be a wizard when assigned to another.

Pencoyd Charley
Los Angeles, Calif

AL SHOULD have a friendly talk with Joe Adams to try to discover the reason why he objects to a promotion. Some men, who appear quite normal, have an internal shyness

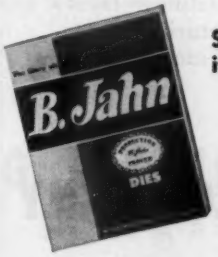
"That's a beautiful new secretary you hired, John. She shouldn't have any trouble at all finding a new job."

and feel inferior to the extent that they are afraid to give orders to others and to see to it that the orders are obeyed. Others feel that the only way to give an order is to talk loud and be bossy, something that perhaps it is not in their nature to do and so they shy away from any position of authority. If that is the person's nature, then he is right in avoiding a promotion since it would result only in failure and he probably would be fired within a few months.

There is the man who cannot give clear straightforward instructions and so he has to "show" how things should be done. I well remember an excellent patternmaker — let's call him Joe—who made most accurate strong patterns and made them quickly. The manager and the superintendent praised him to one another and it became a foregone conclusion that he was the next-in-line to be the pattern shop foreman. One day he was elevated to that position —but he proved a complete failure: If a man was slow in making a pattern Joe would say, "The way you're working, it will take over an hour to finish that job. It should be done in forty minutes. Here, let me show you." Joe would then pull out his watch, take off his coat and tackle the job with vim, vigor and velocity, and probably would finish it in thirty minutes; but, while Joe was putting on his demonstration the patternmaker would be standing by, a little sheepishly perhaps, and in addition everyone who came up for information, to get a requisition signed, to get new work or even just to ask what shrinkage rule was to be used, would sharply be told to "Wait a minute" for Joe did not wish to have his speed record impaired. The result of this was that by the time the pattern was finished there would be anywhere from two to half a dozen employees waiting for Joe. Of course a situation like this could not last long and Joe finally was demoted back to his old job. He then became a sorehead and had to be fired—and the company lost a first class, efficient patternmaker. The superintendent could have saved himself from becoming involved in this error of judgment if he had simply tested Joe on various occasions by making him temporary foreman, at such times as the foreman was away, and thus discovered any serious weaknesses that Joe may have had.

A domineering, positive-talking farmer brought his 22-year-old son to a machine shop one day and said his son (let's call him Joe, again) wanted to become a machinist. Joe, it seemed, had never been anywhere else but on a farm and so knew

Here's a B. Jahn progressive die that performs 10 precise operations on .156" cold rolled steel with one blow—and when a die does that, brother, it's really producing! The stock was so heavy that a 600 ton press was needed—the countryside shook with every stroke—the components were red hot as they rolled from the press at the astonishing rate of 32 per minute. A die that can take that punishment day in and day out must be built—AND BUILT RIGHT! But brute strength wasn't enough. B. Jahn had to build the 10 station die to produce intricate hub bearing retainers so precise that they could be used as they came off the press—with no further machining. Sounds unbelievable, but it's typical of the impossible dies made routine at B. Jahn. Let B. Jahn tool your next "can't be done" job!



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PEARLITIC MALLEABLE CASTINGS

* B1112 STEEL = 100

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NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

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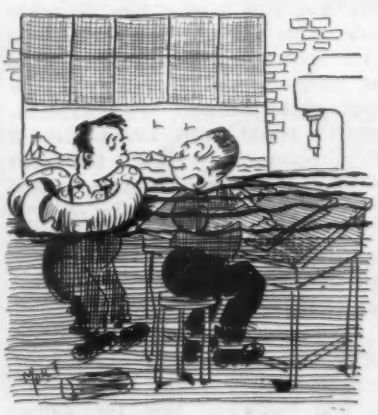
nothing about machine shop work, but he wanted to be a machinist. The farmer did all the talking and it was decided to put Joe on the payroll as a handy man and find out if he would be any good at working around mechanical things. Joe was bright and liked machinery, and soon he was doing rough drilling, grinding, cutting off stock, etc. Then, one day a lot of cored castings came in that wanted rough boring. They could not be drilled because the cores had been roughly placed and since the drill followed the core hole the result would be that the hole finished too much out of line. This seemed a good opportunity to get Joe used to a lathe, so he was shown how to run the general utility lathe on this one job and while the foreman had to spend considerable time in getting Joe lined up, he soon got the idea and spent three days doing, for a first attempt, a commendable job on the castings. Joe was developing into promising material and the foreman spoke well of him—that was until the day after the next pay day. Joe did not arrive until ten o'clock that morning and he was a real sorehead. He went to the boss and demanded a lot more pay, said he had worked three days as a machinist and had not been paid machinist's wages for it. He said his father had told him he had to "demand his rights" and that he would not do another stroke of work in the shop until he was paid his proper rate, also he was to be paid full machinist's wages from now on. Joe's father had butted in and muffed the first chance Joe had of filling his ambition. Joe discovered that he was right when he stated he would not do another stroke of work in that shop for that was what happened—the boss promptly fired him.

There was the pleasant, depend-



"Good thing I got a ball point that writes under water or I couldn't make out the time sheets before we leave."

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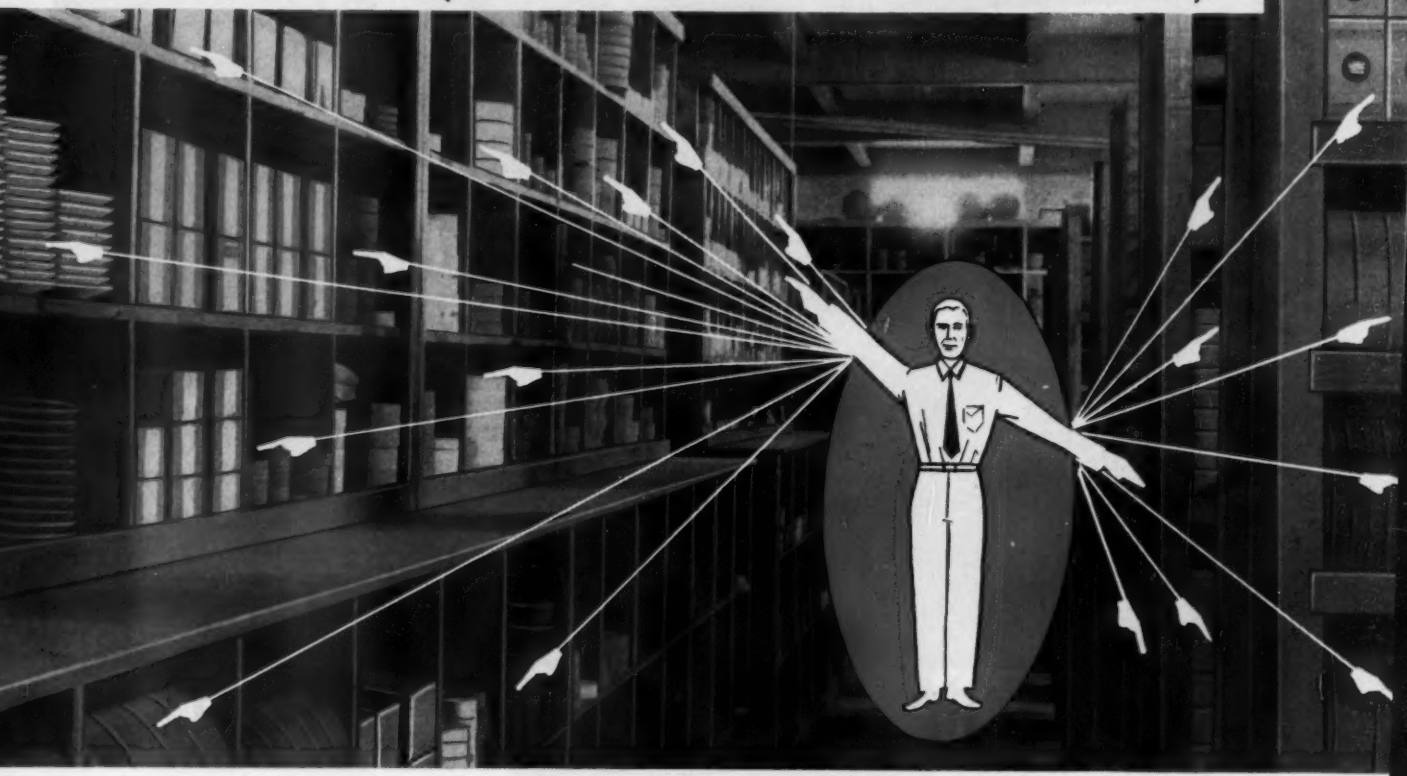

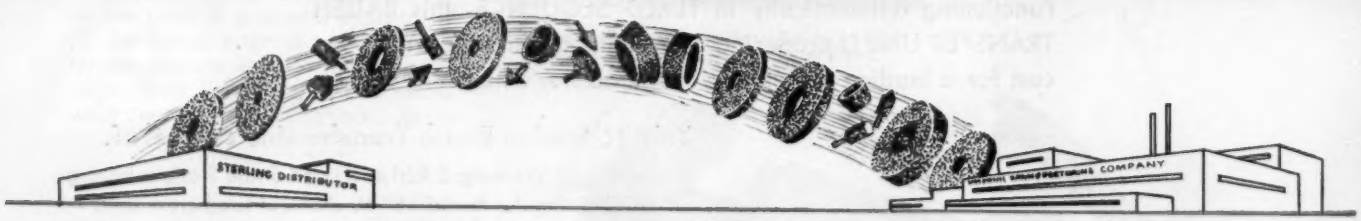

Every Sterling distributor has thousands of "helping hands" pulling merchandise from well-filled shelves every minute to provide day or night service for his customers. With his on-the-spot knowledge of his territory's needs, plus a plentiful stock to meet them, the Sterling distributor's "extra reach" provides fast delivery right now of the proper Sterling Grinding Wheel for your job—or any other important item you may need in a hurry.

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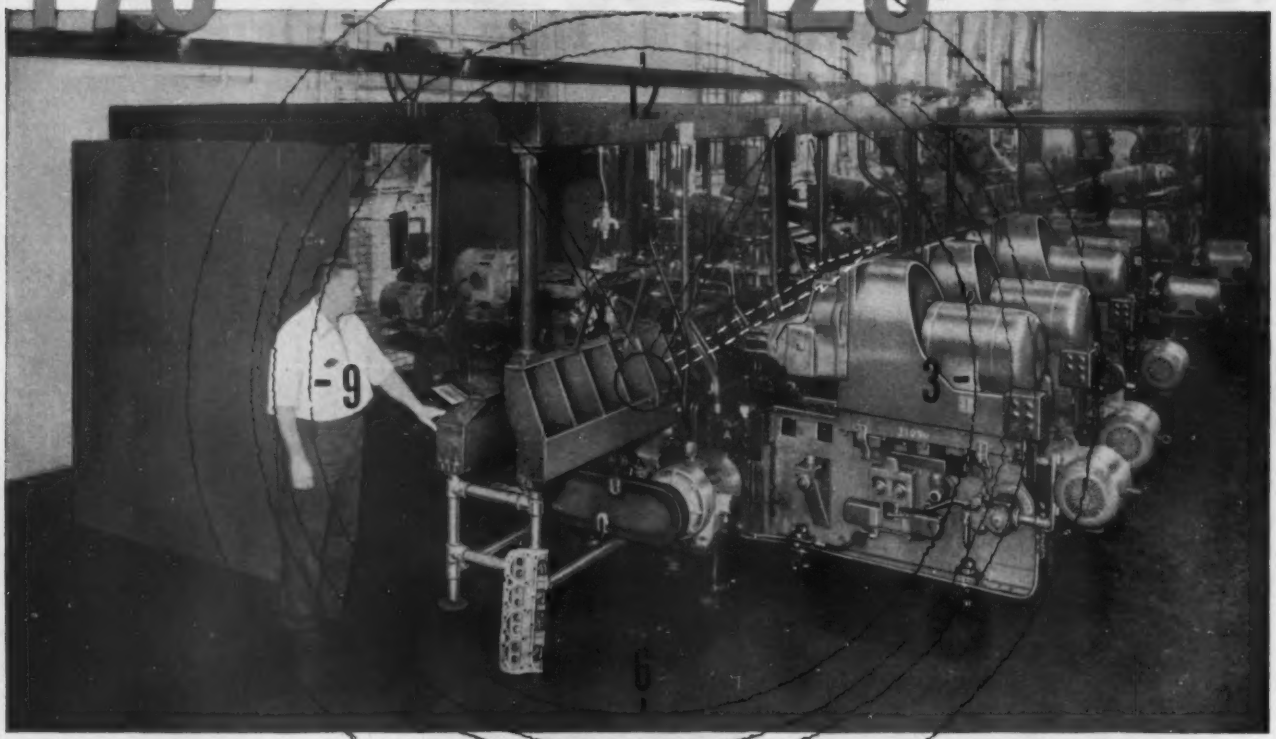
175 Machine Operations on 128 Cylinder Heads



= 22,400 OPERATIONS PER HOUR

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This 21 Station Baush Transfer Line consists of:

1 Loading; 13 Working; 2 Roll-over; and 5 Idle Stations having
12 Vertical Angular Model "S" Mechanical Leadscrew Units —
4 Horizontal Model "S" Mechanical Leadscrew Units —
1 Vertical Model "S" Mechanical Leadscrew Unit —
4 Horizontal 30F-18 Hydraulic Units —
1 Vertical Hydraulic Unit mounted on hydraulic horizontal slide —
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22 Fixed Center Heads having a total of 175 spindles —
6 Transfer Power Units —
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OPERATIONS:

Mill — Drill — Ream — Chamfer — Counterbore and Countersink — Spotface and Tap.

PRODUCTION:

Approximately 128 Cylinder Heads per hour at 100% efficiency.

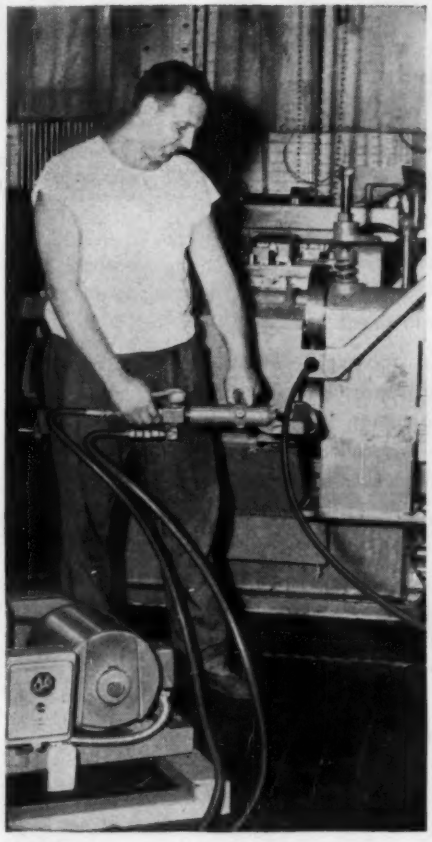
able and good mechanic who was offered the job of foreman; he explained he didn't swear, didn't chew, never raised his voice and that he believed he was not aggressive enough to make a success of being a foreman. The manager thought different and elevated him to that position but he was a failure for he lasted only six months. His failure was not due to any of the things he had mentioned but because he became "a silent man." He never greeted any of the men in the morning; he would walk up to a machine tool and watch the operator for perhaps as long as ten minutes, never say a word and then turn and walk away. He would give a man a job, hand him the blueprint and then walk off. If the man asked for additional information his usual answer was, "Can't you read a drawing yet?" He knew the best way to machine things, but if an operator asked him for a suggestion as to the best way to chuck a piece he would sneeringly say: "Any ordinary machinist should know how to do that. If you can't do your job we'll just have to get someone who can." The men first disliked him and then they detested him and one day the manager walked into the foreman's office and had a talk with him; then the foreman walked out putting on his coat as he went; he was never seen in the shop again—he had been fired.

Promoting a man is a serious business, it should not be on the "Let's give Joe a try; he's been here a long time," notion but it should be on the basis of a careful analysis of all Joe's characteristics as well as his experience and general knowledge. It is also important to know what Joe has been doing in his spare

"—I only want to borrow enough to keep me going till I use it all up again!"

MANCO GUILLOTINE HYDRAULIC

UTILITY PRESS



Fast, easy to use, the Manco Utility Press can be operated by hand valve, as shown above, or by foot valve if desired.

10 Tons Thrust IN PORTABLE UNIT

Here is a highly versatile and powerful hydraulic utility press. Available with different yokes for punching, coining, straightening, riveting, swaging, etc. 2" stroke, 5/8" reach, 1¼" daylight. Special yokes available to meet your requirements. Equipped with Manco 3 h.p. electric hydraulic pump. Weight of head, 18 lbs. The weight of the pump unit including motor is 300 lbs.

NEW MANCO GUILLOTINE CATALOG
also available on complete line of special hydraulic tools for cutting, shearing, punching, bending, riveting.

WRITE FOR COMPLETE INFORMATION

AM-10D

Manco Mfg. Co., Bradley, Illinois
Please Send Me:

☐ Bulletin on Utility Press
☐ New Manco Guillotine Catalog

Name.....
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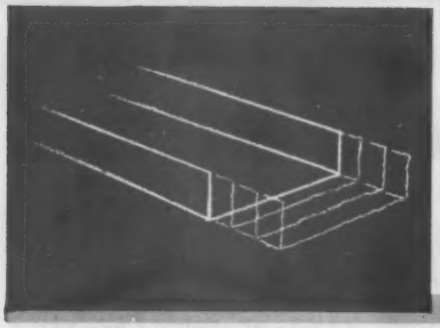
City..... State.....



HOLCROFT and the SHAKER HEARTH FURNACE

Volume Production of SMALL PARTS

Controlled atmospheres—heating—fuel economies—stock handling. All these are factors to consider when you are trying to determine which heat treat furnace to select.

Take stock handling, for example. You might well consider a shaker hearth furnace if you are a volume producer of small parts such as screw machine production or stampings. It's continuous—a type of stock handling that's geared to production flow—and a type that eliminates the possibility of a bottleneck in the heat treat department.

The work is either manually or automatically placed directly on a hearth which is designed to move forward quickly a few inches, stop suddenly, and then return to its original position. The sudden jolt slides the parts through the furnace. An alternate arrangement is set up so that the hearth moves forward slowly, halts, then snaps back to its original position. Either method assures uniform heat treatment of each individual part.

You can get engineering information—honest appraisals of your problem—if you consult Holcroft when you are planning expansion. The result is bound to be a heat treat facility *balanced* to your production requirements. It will cost you less in the long run! Write today for complete information!

Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Michigan.

BUILT BY HOLCROFT & COMPANY DETROIT-MICH. PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

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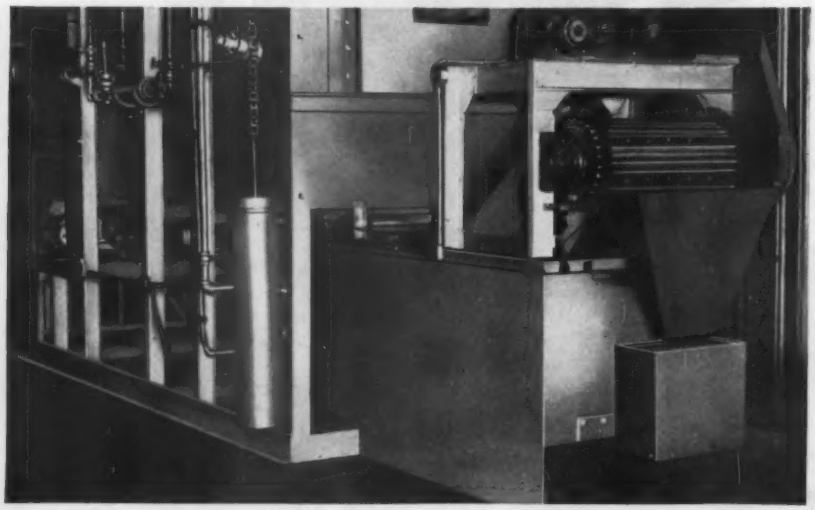
HOUSTON, TEXAS LOS ANGELES, CALIF. PHILADELPHIA, PA.
CANADA: Walker Metal Products, Ltd., Windsor, Ontario



time, and some knowledge of his home life is a great help.

George P Pearce
Albuquerque, NM

THERE'S an old expression to the effect that you can't make a silk purse out of a sow's ear. With no inference at all to the status of a toolmaker I'll paraphrase that by averring that you can't make a good executive—one who isn't afraid of responsibilities—out of a contented workman who questions the advisability of taking on a hell of a lot of trouble for a slight increase in pay for a job that confines him to the rack for many more hours.

Joe Adams is one of many fellows who is hapypy in his job. So, Al, why not let well enough alone and let him remain so; at the same time console yourself with the fact that you have a sound element in the production line. Just because he happens to be a crackerjack toolmaker is no reason why he should be considered as being good material for an executive position. Invariably a good worker is transformed into an unhappy failure by pressuring him into taking on a job at which he feels that he cannot handle.

There is the possibility that Joe is bluffing when he gives the impression that he is afraid to tackle the job of responsibility. He may have one of those efficient-working minds constantly on the lookout for his own particular interest. Undoubtedly he is using that as a tactful stall so as to enable those pressuring him into a job, decidedly distasteful to him, to devote their efforts to someone else. Maybe the man honestly feels that he hasn't any confidence in himself in taking on a job which will, be-

(Continued on page 234)

"That's funny, Boss, I was just looking for you too."

New 6" x 18" hand feed

Thompson Grinder

FOR SHOPWORK OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

ONLY
$2,500*

PRECISION PETE says:

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Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

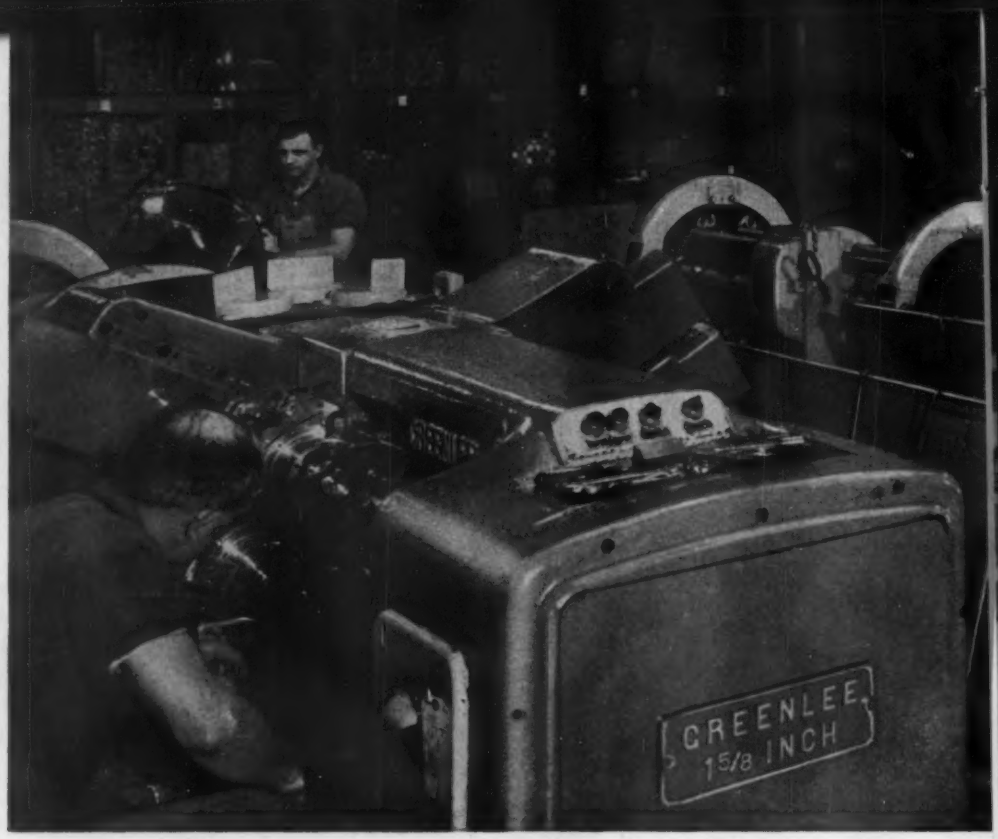
* Price F.O.B. Springfield, Ohio U.S.A., Subject to Change Without Notice.

Call, write or wire today

Thompson Grinders

The Thompson Grinder Company at Springfield, Ohio

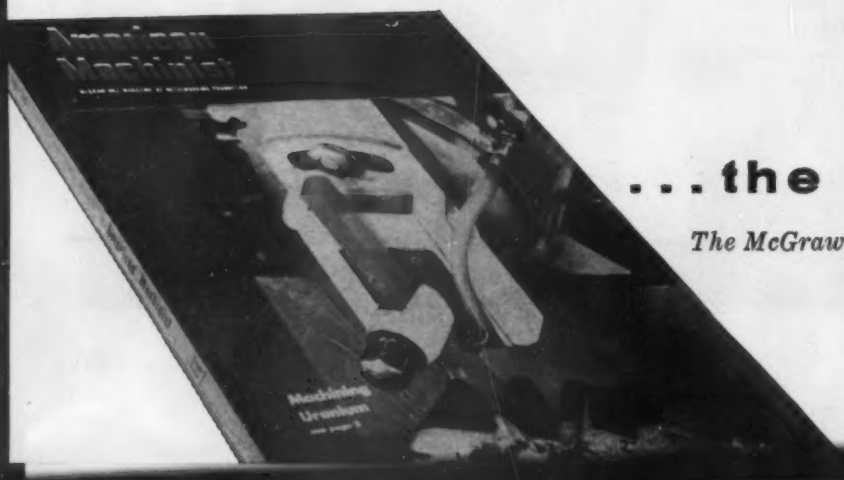
Precision metalworking is the major production operation on almost all products of Blackhawk Manufacturing Company, Milwaukee. This growing company identifies itself as the *"world's largest manufacturer of hydraulic tools."* The Blackhawk line includes jacks, "Porto-Power" remotely controlled hydraulic jack equipment and pipe benders, plus hydraulic cylinders, pumps and valves. Illustrated here in a modern Blackhawk plant is a battery of automatic screw machines used for manufacturing thousands of parts for the products this company sells.



"96.9% of every

Every metalworking company is in business to manufacture products they can sell successfully . . . and the first and biggest order of business is to keep Production supplied with everything it needs.

At the Blackhawk Manufacturing Company, for example, 96.9% of every purchase dollar is invested in the machinery, equipment, materials, and supplies used by Production.



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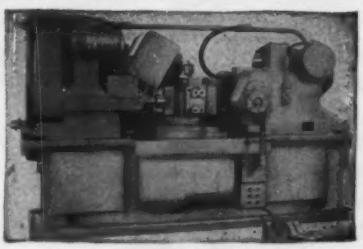
ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



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QUALITY PRODUCT-QUANTITY

GOSS *and* DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

yond a shadow of doubt, cut inroads into the contentment he has spent years in acquiring. I think the man is displaying good sense in wanting his own future to be a happy one, in which his family can share his peace of mind instead of cowering at his approach because of some shop problem the likes of which he could not shake. Carry on, Joe, and stick to the vise and as you shove that file through the hole take a glance occasionally at the boss scratching his weary head over a pile of orders, specifications, and complaints from the big boy in the front office.

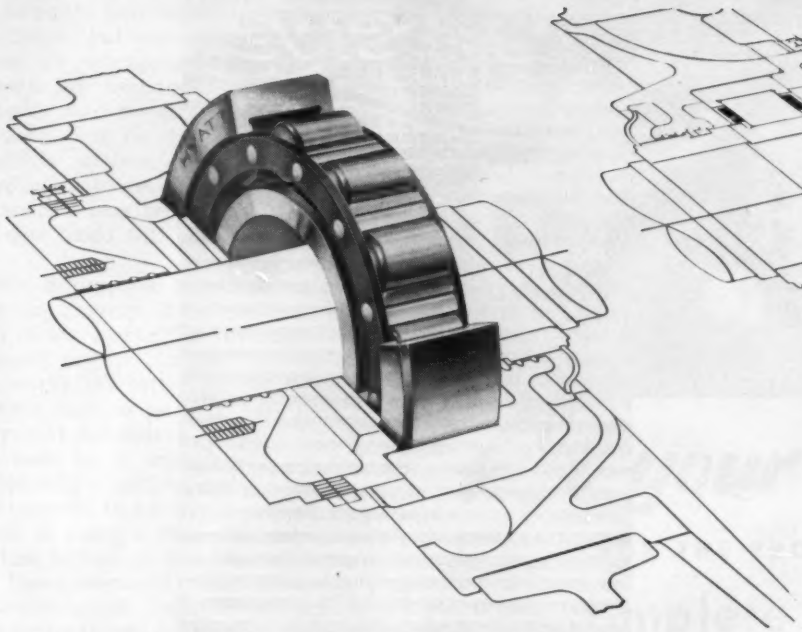
To my way of thinking, it would be a grave mistake to promote a man without first consulting him. I'm not making any wild stabs about what this does to a man because only a few years ago our high-pressure preacher decided to make me a deacon without first asking me whether I would be willing to take on the job. I yanked the covers of the fifth amendment over me and said to hell with it and quit his flock. Just think how a happy toolmaker would feel if his foreman told him he was to take over the artery-hardening, heart-tearing, arthritis and ulcer-producing task of handling a difficult job with perhaps a ten cent an hour increase in pay! It sounds too much of military technique in which the person does as he is told or else.

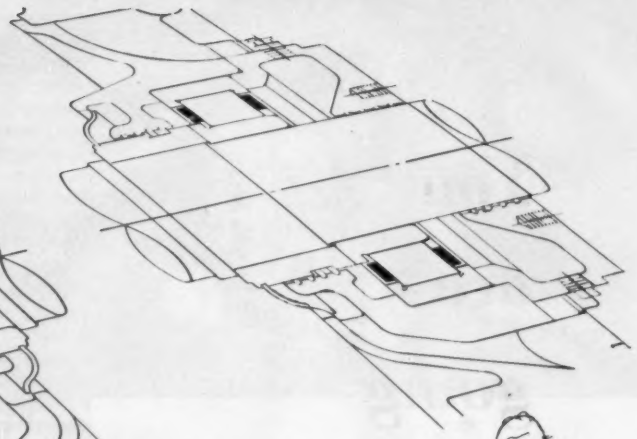
We admit having difficulty in securing men of high caliber to handle certain kinds of work so, when we do have a good one who is sublimely happy in doing it, why try to yank him out of his natural berth so as to put him at something else he expresses a great dislike in doing? Things have come to a pretty pass when a foreman feels that he will be obliged to promote either a Jenkins or a Clark—both of whom feel the sting of swell-headedness at the ear-

"I'll say one thing for Smelby. I know what he's doing every minute of the day."

How Hy-Loads can help you . . .

OVERCOME OVERLOADING





HY POTENUSE, the sage of the slide rule, says:

This HYATT Hy-Load is heading for a long hard life. It's been designed into as tough a job as you can hand any bearing—the armature shaft of a steel mill motor.

These HYATT Bearings must maintain the armature on centers with very close running clearance despite the fact that *steel mill motors are frequently overloaded and are regularly reversed under full load!*

But ability to "take it" isn't the only reason leading motor builders mount HYATTS on both ends of armature shafts: the offset of the flanged inner race provides vital *inbuilt, non-adjustable free end float*, permitting the armature to center itself electrically. What's more, HYATT'S *separable and interchangeable* races facilitate quick replacement of armatures.

See why so many smart designers agree? *You can't go awry when you specify*—

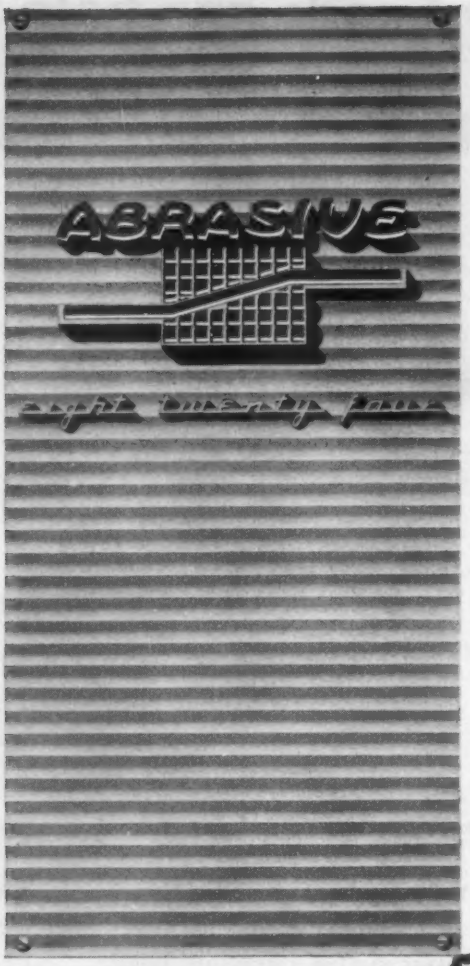
YOUR COMPLETE LINE
OF CYLINDRICAL ROLLER BEARINGS

HYATT

ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY



You are going to see new things from ABRASIVE

The new Abrasive name plate above gives you a hint! In 1956, our fortieth anniversary, Abrasive will introduce a number of important developments in their well known line of surface grinders. For your greatest production year, keep your eye on Abrasive pioneering in 1956.

ABRASIVE
Machine Tool Company
Dexter Road, East Providence, Rhode Island

Sorry! We can't show this revolutionary new Abrasive in detail. Look for it in 1956.

liest opportunity—if the man he feels ideally fitted for the advancement turns down the thing for reasons he alone knows best. If Al has no one but poor material to choose from, then let him try to get what he wants from the outside. I believe in doing the best for the men already on the job but when a time comes to meet an emergency such as this, where an assumed qualified and worthy man rejects an opening for reasons best for his own and his family's welfare, we have no recourse but to get a man in from the outside. It may be that the injecting of new blood will be of great benefit.

Mr. Editor, you ask "How safe is Adams, anyway, if he refuses to get out of the corner?" If it's safety for himself or the company for whom he works, it's better that he be in a corner than to be in a hole which a man of that nature certainly would be were he to undertake a job replete with situations and heartaches detrimental to his health and happiness. It takes a thick-skinned individual to take on the responsibilities of these advanced jobs. He has to have invincible fortitude to weather the many storms of trouble constantly confronting the leader of others—the buffer between the worker and the upper crust in industry.

Frank Van Horn
Auburn, Calif

I THINK Al is asking for trouble if he promotes a man who has no desire for extra responsibility; in fact, he may be doing both the company and the man a disservice.

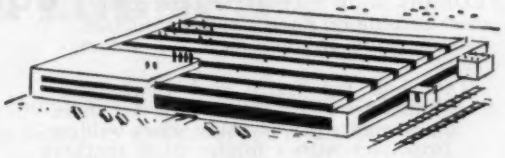
I have in mind a case where this was exemplified. The man in question, whom I will call Joe Roberts, was really an expert machinist, who

"I wouldn't have waited five years to ask for a raise, boss, but I've been waiting to catch you in a good mood!"

At your service...

FOR THE PRODUCTION OF

complete machines, assemblies, sub-assemblies, machine parts



If you are faced with the problem of producing machines or parts for which your own equipment is not entirely adequate, you'll find Crown a reliable source for this kind of work. As one of the leading manufacturers of machinery for the soft drink, brewing and dairy industries, Crown has extensive machine shop facilities and a wealth of experience in producing precision parts and assemblies of the highest order. Let us show you how our plant and organization can serve you.

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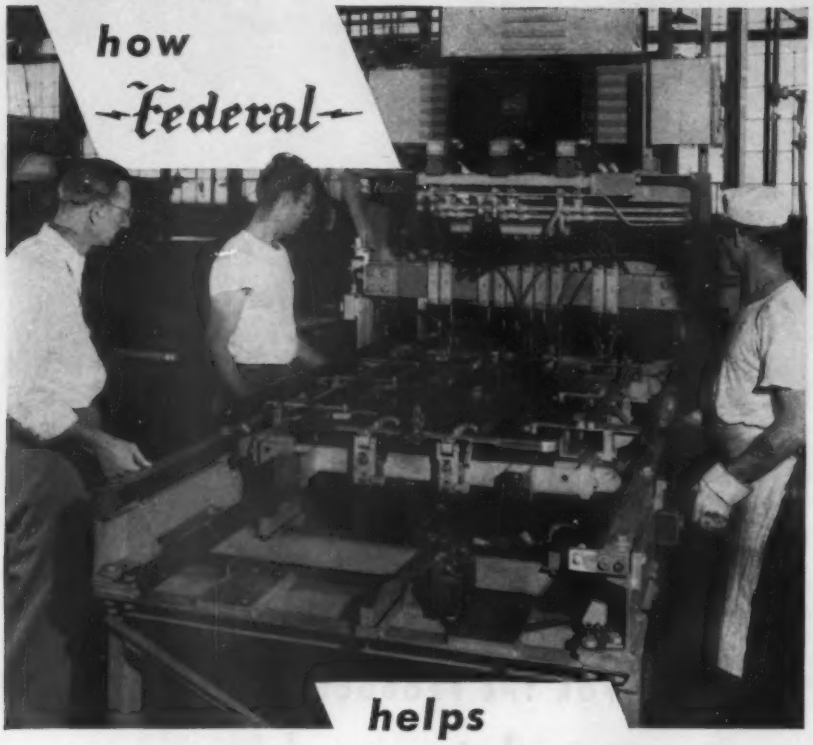
here's how -Federal-



helps Remington Rand make better office equipment

Now, a single operator using a special FEDERAL Multi-Spot Welder can readily meet Remington Rand's high production requirements on their desk top assemblies.

The desk top frame and reinforcing channel are spot welded to the flat sheet top in eighty places, using series welding principles with a minimum of marking on the show surfaces.

Parts are loaded and clamped on the welder die table which is anti-friction mounted on "V" guide ways and automatically indexed under the welding bridge.

Simple and flexible design features permit variable spot spacing in both directions. Pre-selected spot patterns and firing sequences, and readily adjustable part locators and clamps, make for a multi-purpose machine.

If you want the increased production possible with resistance welding equipment, but feel that the operation doesn't merit a single purpose machine, why not look into the possibilities of Federal Multi-purpose welders that can be designed to meet the requirements of several operations. Contact the Federal representative nearest you, or write direct for full information.

-Federal- WELDERS

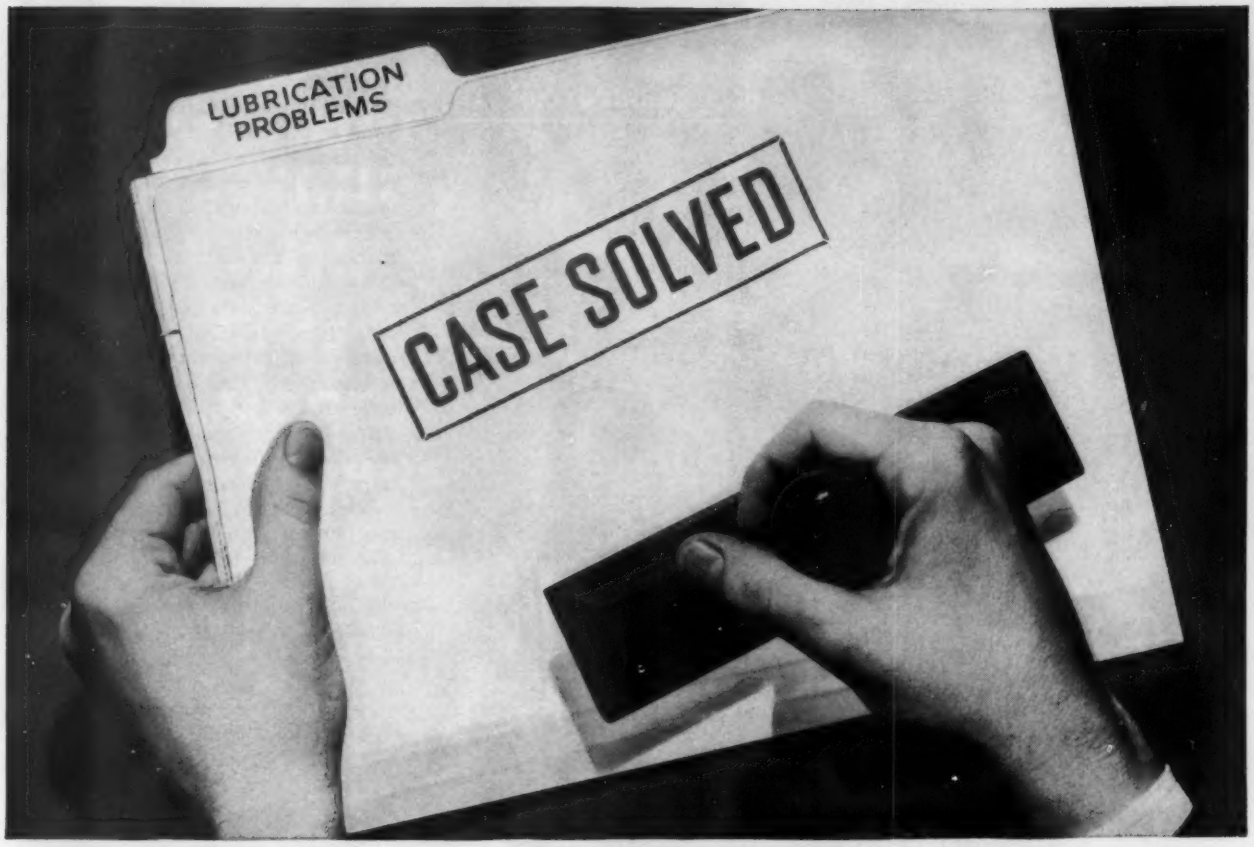
Warco PRESSES

The Federal Machine and Welder Company
Warren, Ohio

went about his work quietly and efficiently, liked and respected by every man in the shop. He was that rare being, an individual who had found his niche in life and had no desire to achieve anything better, being happy the way he was. His foreman, who had talked promotion to him many times, finally gave up asking him and respected his wish that he be left alone. Time passed and the foreman with it, and a new man came along who refused to take "no" for an answer, he, too, being one of those individuals who couldn't understand that a man can be happy and satisfied with life without a great deal of wordly goods and with no desire to assume leadership. So Joe Roberts was "kicked upstairs."

For a while it seemed to work out, because the men respected Joe and went out of their way to help him, but his superior got to cracking the whip over him. Instead of telling his boss to go find a new boy, as he never wanted the job in the first place, poor Joe got to worrying. The emotional conflict of trying to do a good job while being continually prodded to do a better one was too much for him and inside of a year he had a nervous breakdown. Fortunately, someone in authority got the facts in the case and when Joe recovered he was allowed to go back to his old job, where, I am happy to say, he is to this day, with no

"Nope, . . . Sorry . . . You're too good, you'll be here a month and want a raise and you'll deserve one and I'll give you one and it'll make the whole Kaboodle who've been here longer sore; efficiency will decline, the boss'll call me on the carpet, I'll blow my stack; be fired . . . nope . . . can't use you. . . ."



Vilter Mfg. Co. Solves 3 problems with Cities Service Lubricants

PROBLEM 1. Formation of carbon on air compressor valves, necessitating shut-down to clean every three months.

PROBLEM 2. Mixing of oil and water on valve gears and bearings of engine driving Vilter's 600 KWH generator. Constant draining required.

PROBLEM 3. Groaning of corliss steam valves on Vilter's condensing, cross-compound steam engine.

Since 1867, Vilter Manufacturing Company of Milwaukee has enjoyed the reputation of solving difficult engineering problems in refrigeration and air-conditioning. So it was natural that when Vilter had a lubrication problem, it would solve that also. Natural, too, that Cities Service Lubricants would be those chosen to carry out the task.

Says Vilter's Chief Power Plant Engineer, James Murphy: "The valves on our two-stage, high pressure air compressor were coating with carbon so badly that we had to shut down and clean them every three months. Then we switched to Cities Service DC-300 Oil. Now, after nine months, valves are perfectly clean and our carbon problem is gone.

"At the same time we tried Cities Service Pacemaker No. 3 to stop a problem of oil mixing with water on the valve gears and bearings of the steam engine driving our 600 Kilowatt hour generator. The problem ceased and for more than nine months we haven't had to change the oil because it does not emulsify with water.

"We also silenced groaning from the corliss steam valves of this steam engine by switching to Cities Service Optimus No. 3."

If you have a lubrication problem talk to a Cities Service Lubrication Engineer. Chances are he can solve it. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Fluidmotion
GRINDING WHEEL DRESSERS

Forms wheels to shape easy as ABC

ON INTERNAL • CYLINDRICAL • SURFACE GRINDERS • TOOL AND CUTTER GRINDERS

This is the only radii and angle Wheel Dresser that will accomplish the form dressing of 2 angles, 2 radii and one flat tangent in one setting. It comes in several models to form dress wheels ranging from the smallest sizes to those of 24" in diameter.

Fully adjustable, adaptable and semi-automatic in operation, the FLUID-MOTION Wheel Dresser is the only one requiring only a micrometer for setting to obtain any desired form.

Representatives in principal cities of the U.S.

A. Measure over diamond point to back of micrometer plate.

B. Add required convex radius or subtract required concave radius.

C. Tighten gib. Dresser ready for action.

Write for information on the new J & S Purchase Plan.
See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — WHEEL DRESSERS, JAW CLAMPS • PRECISION VISES • DOWN-HOLDING DEVICES — **CLAMPCUT** — PARALLEL BARS

J & S TOOL CO., INC.
870 DORSA AVE.
LIVINGSTON, NEW JERSEY

desire to be anything other than a satisfied human being, doing a good job.

From my own experience, I have come to the conclusion that no man can instill leadership in another unless there is some desire in the other person to supervise. If a man is sufficiently extrovert to have confidence in his own ability and his ability to lead others, you have something to work with, and you can promote him. If, like Adams, he is more of an introvert and lacks the necessary confidence in himself and his own ability, there is very little chance of him making good in a job that requires him to impart knowledge and confidence to others.

Remember this, Al, no matter who you promote, you will have to live with him and accept responsibility for his mistakes, so don't attempt to "make do" with someone who may have to be replaced. Rather find someone outside the department who is intelligent and shows promise of leadership and will respond to training. Your crop of future headaches will be less.

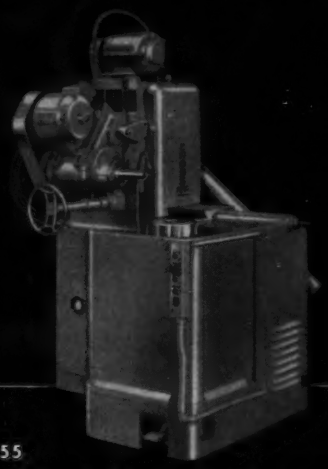
Robert S Alexander
Glastonbury, Conn

ED SHOULD HAVE *given* the guy credit for downright modesty; look out for the self-inflated jackass who goes around bragging about his virtues. I cannot see where a fellow would be considered as being a problem because he declines to accept promotion. This is a free country except that we have to divvy up our share of the cost of that freedom at income tax time once a year. My gosh, Al, don't go around complain-

"Now then, Trimble, what's all this about an oil leak? Er . . . you are Trimble, aren't you?"

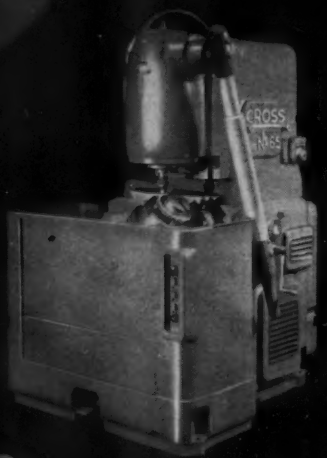
Greater Flexibility with Cross Gear Machines

for rounding • chamfering • pointing • burring



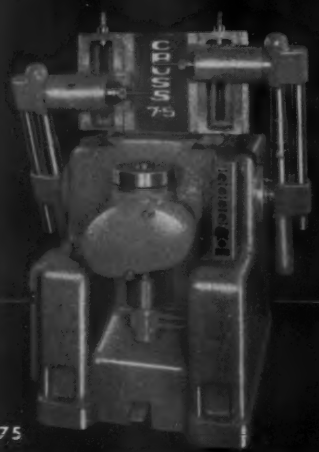
NO. 55

For rounding, pointing, chamfering or burring external and internal—
spur gears • helical gears
clutches • splines
Typical production—rounding or pointing 8 pitch 30 tooth gears—55 net hourly.



NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



NO. 75

For burring or chamfering both ends at the same time—
helical gears • spiral bevel pinions
hypoid pinions
Typical production—chamfering 8 pitch 40 tooth gears—200 net hourly.

- ★ **Flexibility for handling a wide variety of gears.**
- ★ **Rugged, heavy duty construction for continuous high production or job shop operation.**
- ★ **Short setup time (as little as 15 minutes) for changing from one gear to another.**
- ★ **Simple, inexpensive tooling.**
- ★ **Push button controlled automatic cycle.**
- ★ **Hydraulic power work clamping.**

For mass production or short run jobbing operations, there is a Cross Gear Machine to suit your requirements.

Established 1898

THE CROSS CO.

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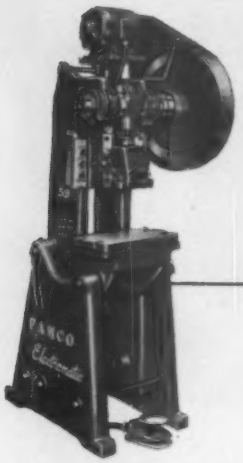
Special MACHINE TOOLS

famco MACHINES

pay real cost-saving dividends



Famco machines—the choice of more and more leaders in the metal-working industry. This ever-increasing stamp of approval is in recognition of the superior quality and performance built into every Famco Machine. All parts are given that extra care in manufacture which means savings in time and money. They're simple to install, easy to operate, economical to use.

POWER PRESSES

Open back inclinable, standard and deep throat in bench and floor models. Ratings range from 4 to 18 tons capacity. Larger models feature the revolutionary and exclusive Famco "Elecromatic" 9-point jaw clutch.

ARBOR PRESSES

Plain lever, simple ratchet, and combination compound and simple ratchet models — bench and floor models, deliver up to 15 tons pressure.

DRILL PRESSES

28 models of 15" presses in single and multiple spindle; tilting table and production models, bench and floor types.

AIR PRESSES

20 models, bench and floor types. ½ to 3½ tons capacity. Built-in electric or air controls, single or dual control type.

FOOT PRESSES

Constructed of semi-steel close grained castings; precision-machined for long, unsurpassed, trouble-free operation. 10 bench and floor models that deliver up to 3¾ tons pressure.

BAND SAWS

4 models of horizontal cut-off saws for dry or wet cutting, with or without coolant system. Capacity: 6" round and 6" x 12" rectangular stock.

SQUARING SHEARS

18 models, modern all steel construction, shear up to 14 gauge mild steel; cutting widths 22 to 52 in. Power models feature single stroke mechanism and the exclusive Famco "Electro-Matic" 9-point jaw clutch.

famco machine company

3136 SHERIDAN ROAD • KENOSHA 105, WISCONSIN

Air Presses • Arbor Presses • Band Saws • Drill Presses • Foot Presses
Power Presses • Squaring Shears

Please send a copy of the Famco General Catalog

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ing of the fellow simply because he has an inordinate dislike for accepting a position which we all know, who have been supervisors, robs a man of the enjoyment in life he is entitled to.

Assuming that there will be an opening for a foreman in the near future, the employees should be given an opportunity to make an application for the job. These applications should be scrutinized by those who are intimately acquainted with the applicants and who know the requirements necessary to make a success of the job. You'll find that for one who doesn't care to take on the job, there will be a dozen who would jump at the chance.

The fact that Joe Adams is a first-class workman does not mean that he has the other qualifications necessary to make him a success as an overseer. It is true that a foreman should know his job so thoroughly that his decisions could be made pronto backed up by experience. Wild guesses are costly, especially if the guesses are made to cover up a bluff.

The expression "pushing the boys around" amuses me. Just try that Victorian stunt these days, Al, my theoretical crackpot, and see how far it gets you. Men don't stand for being pushed around by management these days.

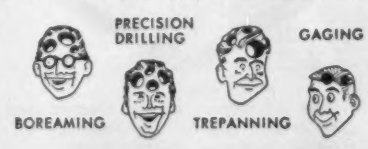
I would think that it would pay management to take as much pains in the selection of its foremen as the state does in determining the fitness of its lawyers, educators, and the like. While we are all aware of the red tape and unnecessary paper work involved, it seems that better results would obtain were prospective foremen given a stiff examina-

"Come now, Ed, what was it you learned in the foreman training classes about the art of persuasion?"

your **MADISON** *man is four men in one!*

The "hole" problem of the machine tool builder calls for an ***unbiased answer*** when selecting the ***proper tool*** for the ***most efficient performance*** of their machines. For this reason, the four-in-one Madison man is the one most frequently called upon to recommend the best tool for the job. He can logically pinpoint ***your*** needs because he has a tool to fit every hole-making application whether it's boring, precision drilling, trepanning or gaging. The broad knowledge and experience of your Madison man lowers hole costs through savings in time and money. Besides full production economy, you get better finish with greater accuracy. Submit your problem to "the men with holes in their heads."

"the men with holes in their heads"



MADISON ADJUSTABLE REAMING TOOLS

Write for your information-filled Madison Catalogs on Adjustable Boring and Reaming Tools, Precision Drills, Trepanning Tools and Adjustable Boregages.

MADISON MANUFACTURING CO. INDUSTRIES, INC.

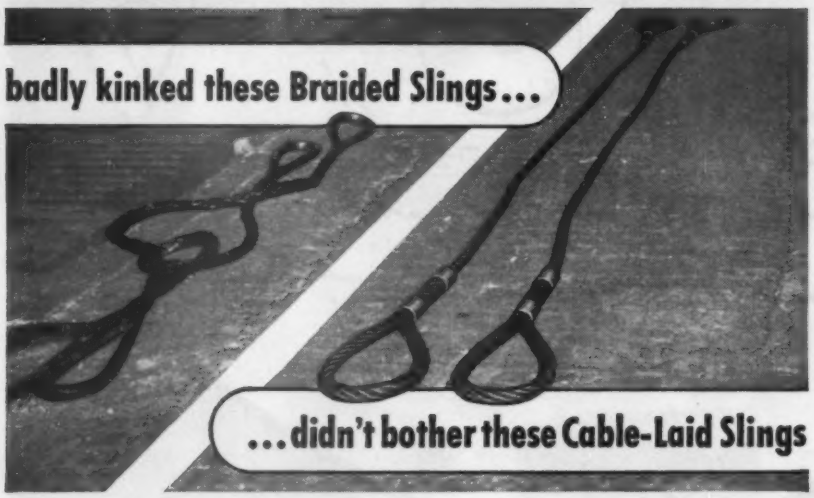
DEPT. AM, MUSKEGON, MICHIGAN

"inner diameters are our business"

This 34-Ton Load...

ACCO products

badly kinked these Braided Slings...



...didn't bother these Cable-Laid Slings

Here's Why:

Because these ACCO *Registered* CABLE-LAID slings combine the flexibility of manila rope with the strength of steel.

The secret of the CABLE-LAID sling is in the construction of the rope. It's a combination of six wire ropes laid around a special steel center to give you a rugged steel body which has:

- **Freedom from Crankiness**
- **Extreme Flexibility**
- **Resistance to Kinking**

With their patented DUALOC endings these CABLE-LAID slings are tops in ease of handling . . . resist abuse . . . and give you longer sling life which reduces lifting costs. And these slings are ACCO *Registered*—with all the advantages that make this specification the standard of efficiency and safety.

See your ACCO Registered distributor or write our Wilkes-Barre, Pa., office today

ACCO

TRADE MARK

Wire Rope Sling Department
AMERICAN CHAIN & CABLE

for Better Value

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

tion so as to determine their fitness for the responsibilities dependent upon them. A leader of men must be a pretty good psychologist in a practical way in order to deal with the multifarious problems pertaining to relationship between the employer and employee, and he must be capable of exercising sound and fair decisions arising from differences between the employees themselves.

It could be that one shop may have a high percentage of foremanship timber, whereas another may show a great dearth. Every man is not cut out to be a leader and there are many who would prefer to be led by others because of the lack of ambition or whatever one may call it. Simply because a man chooses to take a Greta Garbo stand—wants to be let alone to enjoy his own life—shouldn't classify him as being uncooperative. It's the man's nature, and you'll have to take him at his face value—damn high and of exceptional worth because of his standing as a dependable worker. No matter how much know-how a person has about the business concerned it does not mean that he is fit to assume command. In the Navy an officer can be a Captaing Queeg —a mean, cold-blooded individual working for his own interest, and hated by the members of his crew yet, through force of his domineering leadership and the traditions behind him he can get away with almost anything short of murder. Not so in industry—no siree. The cap-

(Continued on page 248)

"I was just passing by and thought that I'd drop in and ask for the afternoon off, an increase in salary, a little longer vacation, and a retirement pension."

Tube Makers Please Note —

A tube mill represents a major investment. Good business practice dictates that before you invest — you should investigate.

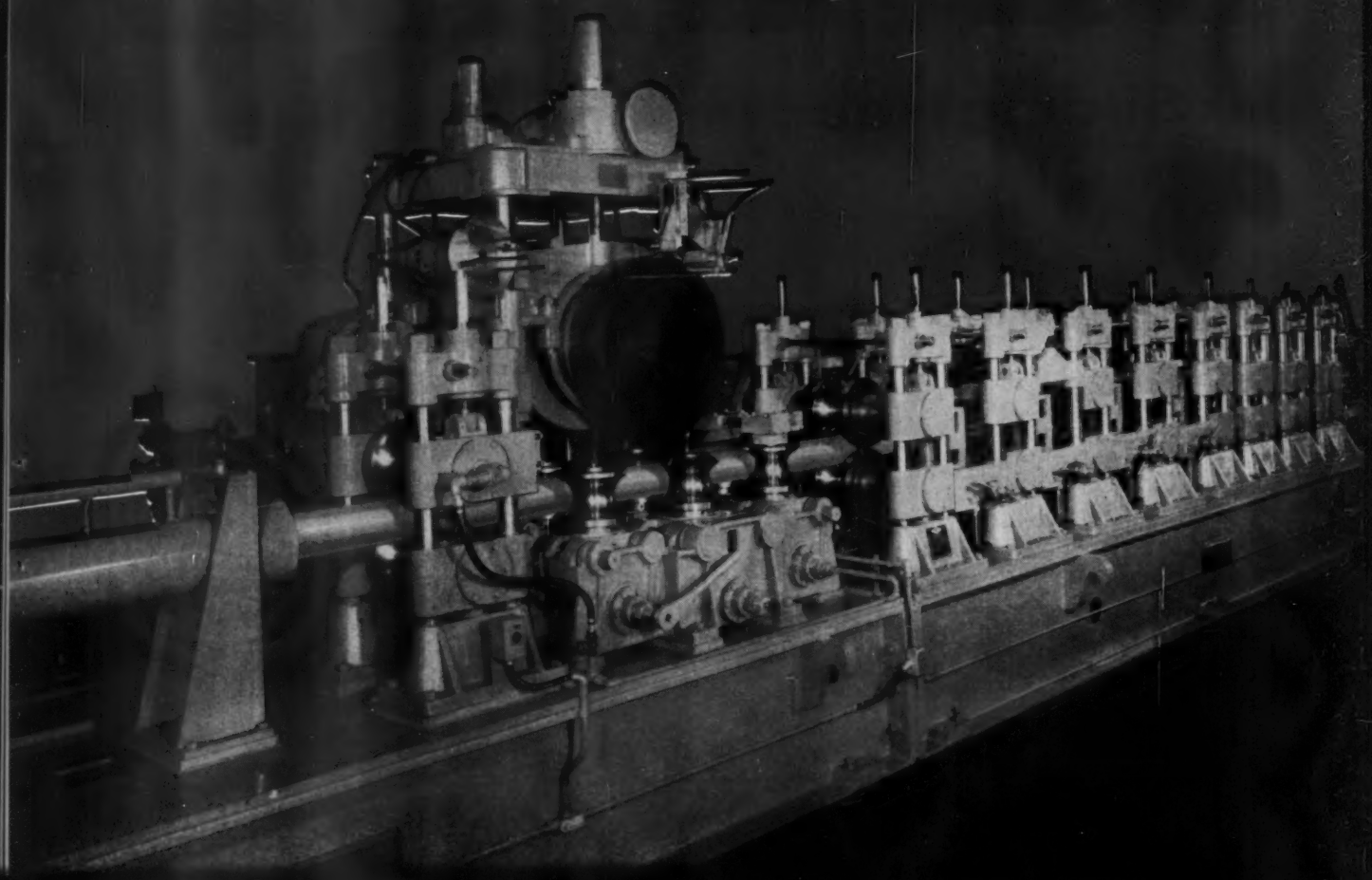
We here at McKay believe we build the finest tube mill made today. We could point to many features that support this belief. However, these features are all a part of our determination to constantly improve the product, and to *never substitute for quality.*

Experience has proved the most expensive single item in tube mill operation is *down time.* This time lost can quickly mount into thousands of dollars — making any savings in the initial cost of equipment trivial by comparison.

Every McKay Tube Mill is designed to deliver the ultimate in PERFORMANCE, PRECISION, RUGGEDNESS and SAFETY. Compare! Investigate thoroughly before you buy and we feel sure you'll specify TUBE MILLS by McKAY.

THE McKAY MACHINE COMPANY, *Youngstown, Ohio*

Designers and builders of modern tube making, forming, sizing, reducing, welding and cut-off equipment.



Radically NEW Concepts

New "Series A" Automatic Drilling and Tapping Machines

New automatic cycle—rapid approach—feed—rapid return through simplified electro-mechanical design.

New rigidity and power from heavier structure, efficient drive and higher horsepower.

New applications through universal design and broader feed, speed and tap lead ranges.

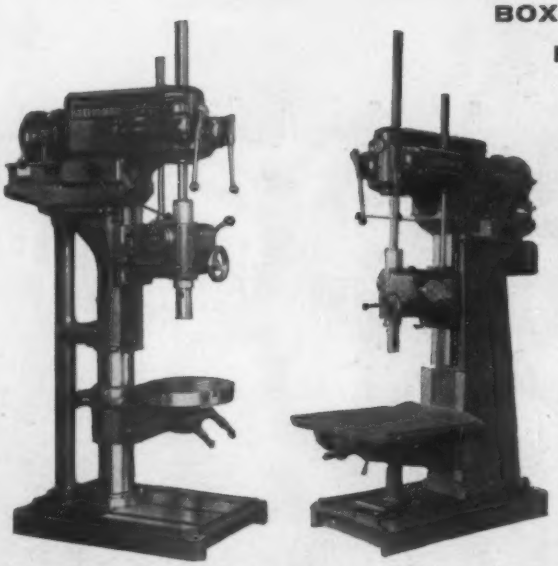
New lubrication facility with 100% anti-friction bearing design—lower operating costs.

New approaches with simplified fixturing can often double or triple output.

DRILLS AND TAPS HOLES AT THE TOUCH OF A BUTTON

Sliding Head Drilling Machines

BOX COLUMN AND ROUND COLUMN FOR LOW OPERATING COST



New rigidity in really quick change multi-speed, multi-feed Upright Sliding Head Drilling Machines.

New stiffer, heavier spindle for longer life and higher production.

New faster set-up facility for easier operation and less idle time.

New involute spline drive throughout for increased capacity and lower maintenance.

New accessories for broader application and increased efficiency.

by CLEEREMAN

New Precision Jig Borer

New structural concepts give 100% support to heavy work throughout entire range of machine.

New automatic ultra-precision positioning eliminates manual operation of table and saddle elements.

New guide design insures longer, more precise alignments of table and saddle.

New spindle nose tooling gives faster handling and higher efficiency.

—A new procedure for tool room or production work with increased output, precision and profit.

Layout Drilling Machine

A MODERN SOLUTION TO AN OLD PROBLEM

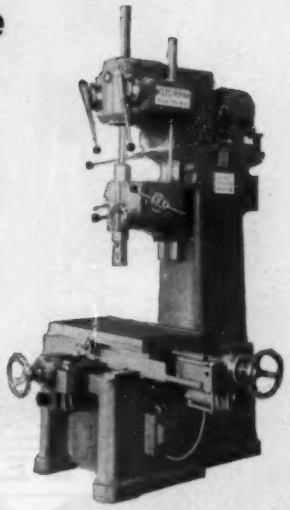
New approach to tool room and production layout work not requiring the ultra-precision of the Cleereman Jig Borer

New increased output through easier operation and control.

New efficiency with new spindle nose tooling.

New rigidity with improved structure and increased drive capacity.

New longer precision life with improved design of elements.



BRYANT Machinery & Engineering Company

General Office
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Representatives in Principal Cities

AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO., Green Bay, Wis.

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

BE *Sure* YOUR
NEW ENGINE LATHE
CAN *Take* IT!

The engine lathe you buy today could be the one you will call upon for 'round-the-clock production. Make sure, before you buy, that the lathe of your choice can take such punishment.

ASK ONE QUESTION!
What is the headstock gear arrangement?
MAKE SURE OF THREE POINTS

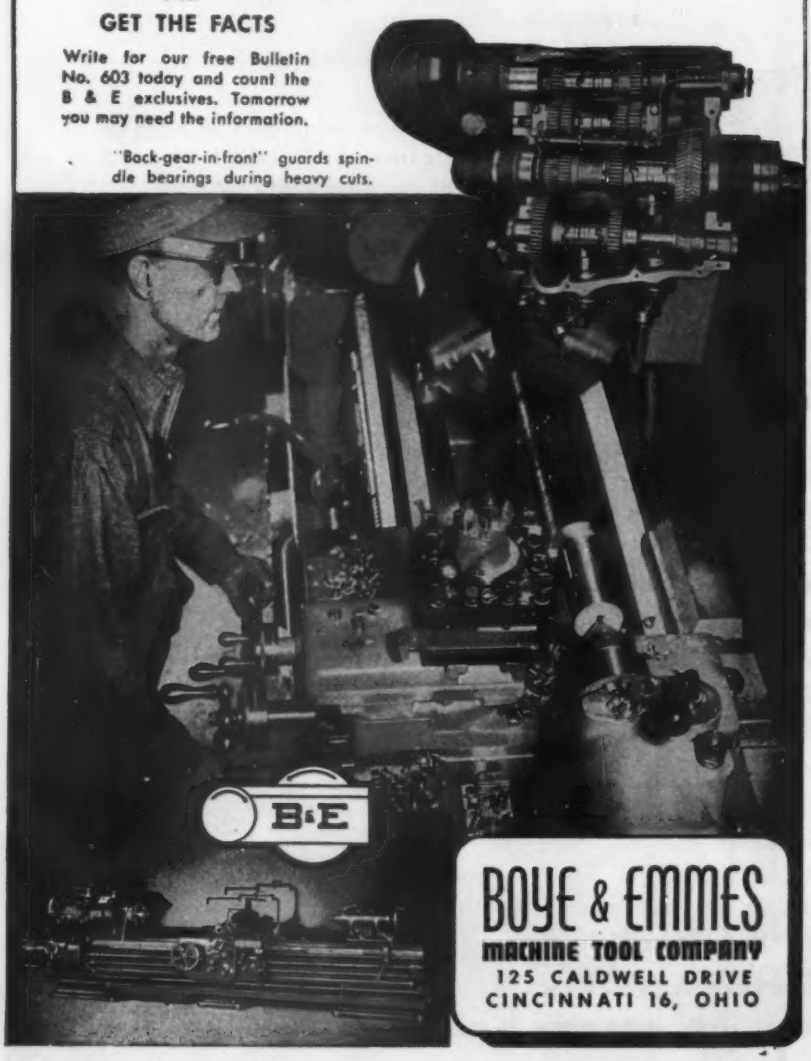
(1) That all gears are arranged in a horizontal plane; easy of access.
(2) That gears are in constant mesh, with speed changes effected by means of sliding jaw clutches; eliminating gear wear due to shifting action.
(3) That the "back gear" is in *front* of the spindle, exerting its powerful downward thrust to offset the lifting action of the tool when heavy cuts are made.

On these three points long life for engine lathes depends. At these three points Boye & Emmes Long Life, Heavy Duty Engine Lathes excel

GET THE FACTS

Write for our free Bulletin No. 603 today and count the B & E exclusives. Tomorrow you may need the information.

"Back-gear-in-front" guards spindle bearings during heavy cuts.



BOYE & EMMES
MACHINE TOOL COMPANY
125 CALDWELL DRIVE
CINCINNATI 16, OHIO

tain—the shop foreman—has to be a human being in every sense of the word. In years long since past he could be a Simon Legree and still make a go of it but thank heavens those birds have been eaten up with worms years ago.

The modern foreman must understand human nature and, what is more important, he must command the respect of his workers and make them feel that he is working for their best interest as well as his own and the company's welfare. I feel that a careful study should be made of an applicant for a position of foremanship—an objective appraisal by someone or a committee especially fitted to determine a man's potential in the way of leadership and humane consideration for his fellow men.

Harrison Mitchell
Topeka, Kan

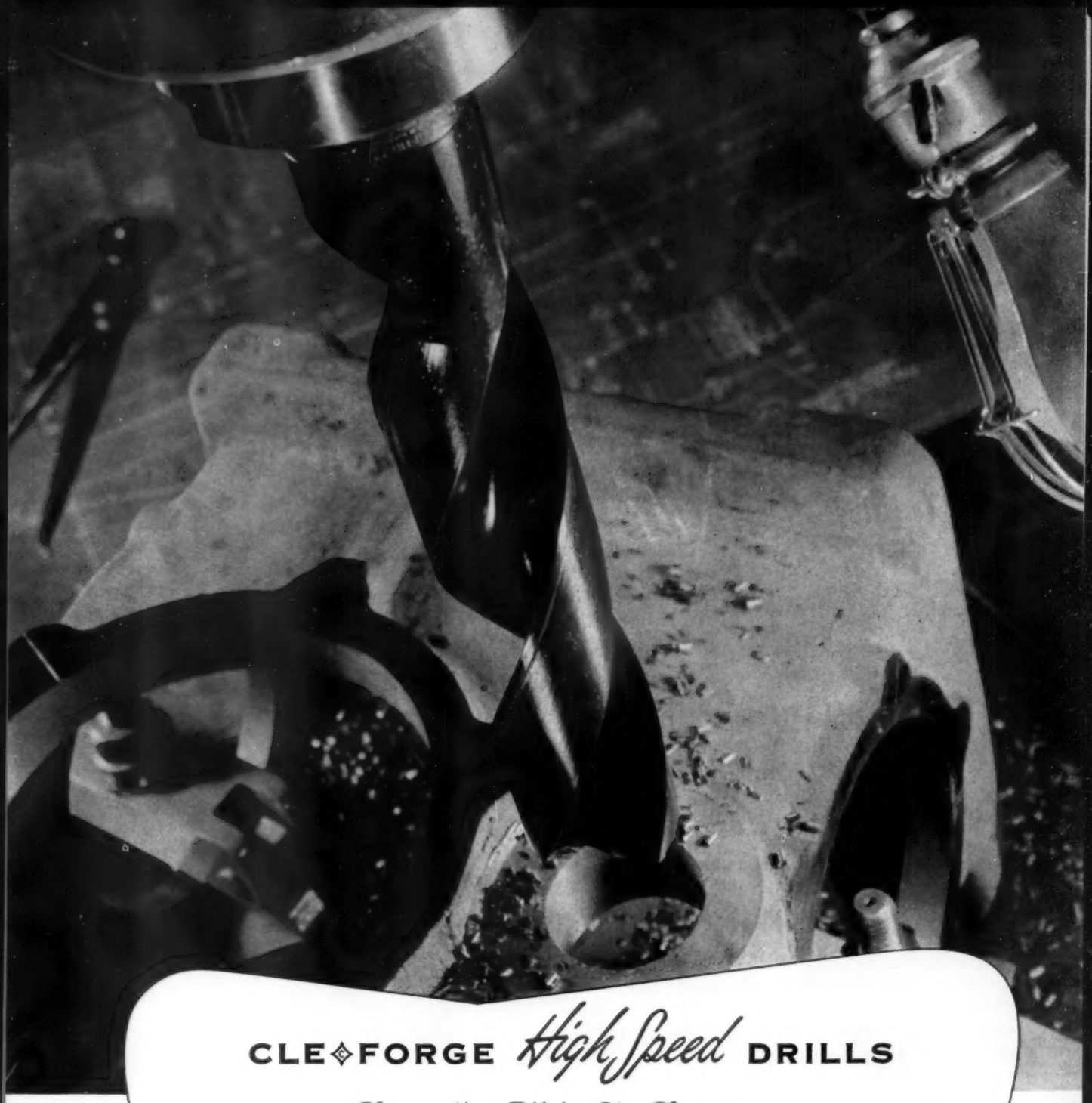
GRIND OR GALLOP?

Will making an apprenticeship course more attractive in terms of pay and promises draw more candidates? Or will keeping the course tough weed out the half-hearted and unsuited?

YOUNG MEN coming out of high school or college today seem to think that there is something better in life for them than just being a toolmaker, and spending the rest of their time in a factory. Probably there is something better for some of them, but not for all.

How to convince the few to become toolmakers is the big problem for managment today. Management

"I don't wear regular shop clothes because these red hunting togs help me from becoming a casualty around here."



CLE◇FORGE *High Speed* DRILLS

Give More Holes Per Grind

On every job — no matter how difficult it may be — you'll appreciate the *extra* quality in these famous drills. They produce better work faster, at lower cost. No other drill gives you such outstanding *performance* and *economy.*

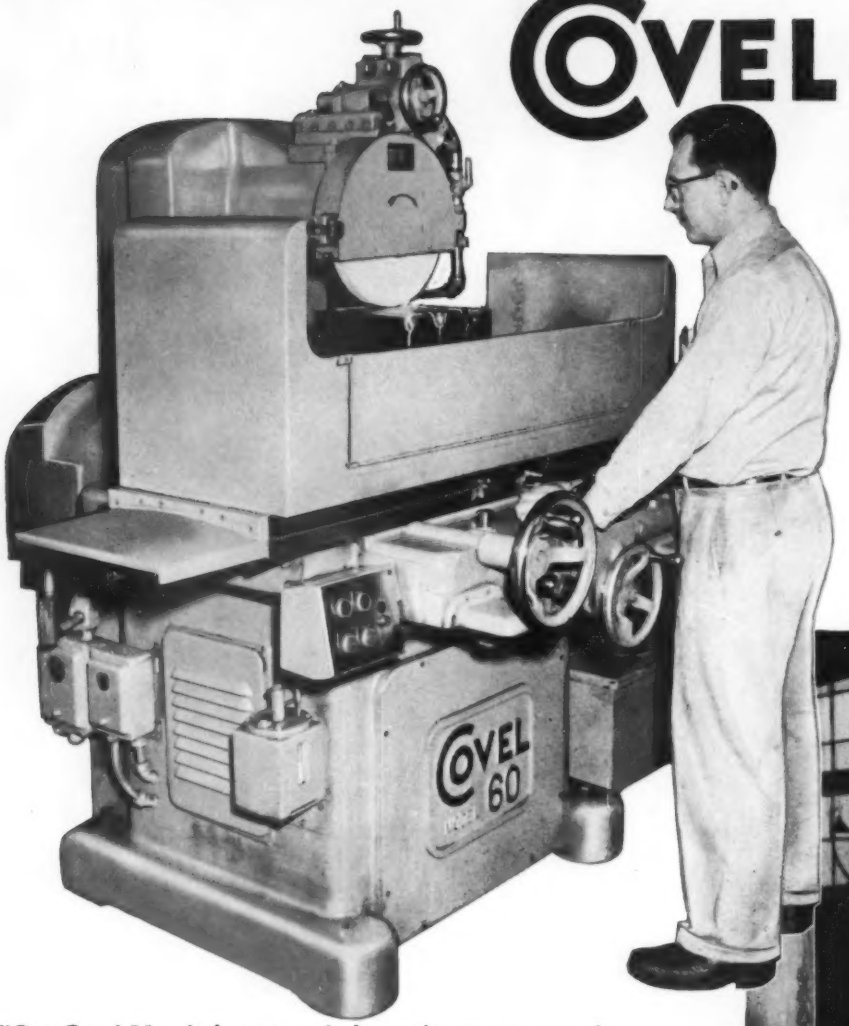
THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

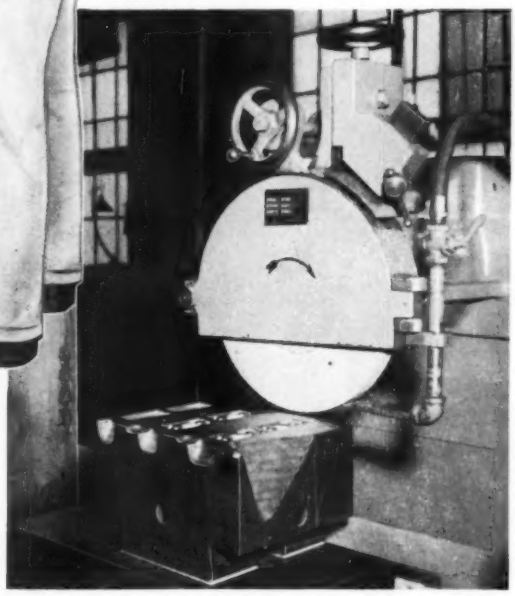
"Capacity for every Job"

COVEL No. 60

HYDRAULIC SURFACE GRINDER



Set up for grinding 340 pound, 10"x 12"x 7½" hammer die for cross over clamp — just one of a wide variety of jobs the Covel No. 60 is performing daily for this Chicago manufacturer.



"Our Covel No. 60 is constantly in use because we can depend upon it to do such a wide variety of jobs. We grind everything on it from thread rolling die blanks measuring 12" x 13½" x 2" to our large hammer dies. And, our operators really like the ease of operation, and the important safety factor provided by the convenient position of the elevating handwheel."

That's the comment of a nationally known manufacturer of pole line hardware. This versatile, precision-built grinder can solve your grinding requirements within a minimum of floor space—*Write for descriptive Bulletin AM-225.*

COVEL HYDRAULIC SURFACE GRINDERS

	(No. 20)	(No. 35)	(No. 60)
Work Capacity	6" x 18" x 12"	8" x 24" x 11"	15" x 24" x 18"
Grinding Wheel	10" x ¾" x 3"	12" x ¾" x 3"	14" x 1" x 3"
Spindle Motor, H.P.	1½	2	3
Floor Space	78" x 58"	97" x 61"	97" x 78"

COVEL PRECISION GRINDERS | **BENTON HARBOR MICHIGAN**

HYDRAULIC & HAND FEED SURFACE GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • DRILL GRINDERS

is part to blame for some of this resentment in the younger generation in not wanting to spend four to six years in learning to become a toolmaker because of present methods of line production in the making of jigs and fixtures. A toolmaker of today does not have the opportunity to start a tool and follow it through to completion. Therefore, he does not have to know all of the fine points in making tools. He is not a toolmaker in the sense that we used to know him; he is just a specialist in one field of making tools, and he knows it.

I am inclined to agree with Ed on the subject of pay. To up the pay would only tend to induce boys to become apprentices for the extra money, and not necessarily to become toolmakers. To achieve any goal, one has to pay a high price. The price that one pays can only be returned in later life in the form of know-how, which creates job security.

W R Hufendick
Quincy, Ill

THE NEED for highly trained, skilled men is constantly increasing, yet the number of men being trained by apprenticeship programs is decreasing.

The system of taking on apprentices and instructing them in the techniques of a particular craft developed in the urban communities of the middle ages. This system of training was an essential part of the craft guilds of that era. These craft guilds were associations of citizens, chartered either by the local government or by the crown, for the purpose of regulating and preserving a monopoly of their own occupations. Full membership in the guild was attained only by artisans who had passed through the successive stages of apprentice, journeyman and mastercraftsman.

The master did not always fulfill his obligations to the apprentice, but there is abundant evidence to the effect that employment relations were, for the most part, intimate and congenial. The opportunity for economic independence which the industrial system of the times afforded was undoubtedly an important factor in the peaceful and cooperative relations which existed at that time. Every apprentice and journeyman employed by the master had hopes for and a good chance of becoming a master. The road to economic independence was open to those who possessed sufficient industry and ambition to travel it.

The forces of economic and social

OUTSTANDING!

Never Before Such Versatility and Accuracy Available in its Price Range!

K. R. WILSON'S NEW FOUR COLUMN DOWN-ACTING HYDRAULIC PRESSES

Here's the Guided Platen Press that's setting new standards in efficiency, low cost metal forming and drawing, plastics and rubber molding, laminating, die cutting, assembling, die tryout, pressing and many other applications that require precise control of an accurately guided platen. Here are the details:

A standard line of 25-200 tons capacity four column presses built to accuracy heretofore obtainable only from costly custom-built presses. Platens are align-bored to optically controlled tolerances.

Operational Features: variable pressure • adjustable stroke • adjustable daylight • wide range of speeds • fast traverse with slow pressing • variable speed • manual, semi-automatic and full automatic controls.

Design Features:

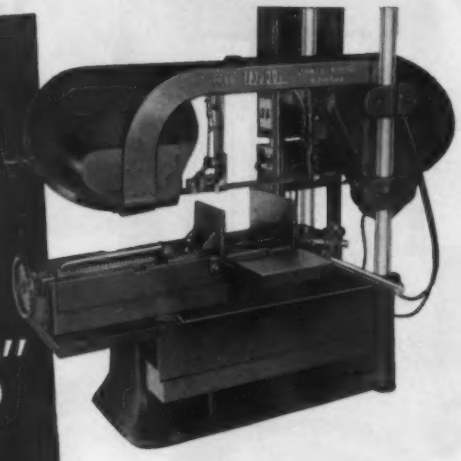
- PLATENS ARE ALIGN-BORED for greater accuracy.
- EXTRA-LONG PLATEN GUIDES have renewable bronze bushings and lubricating fittings.
- POLISHED AND GROUND COLUMNS resist wear and increase accuracy of platen travel.
- MAXIMUM STROKE SAFETY LIMIT CONTROL prevents damage to dies or press due to over-travel of platen.
- COMPACT, SELF-CONTAINED PUMPING UNITS insure dependable, trouble-free service.
- CUSTOM ACCURACY, custom quality at standard line prices.

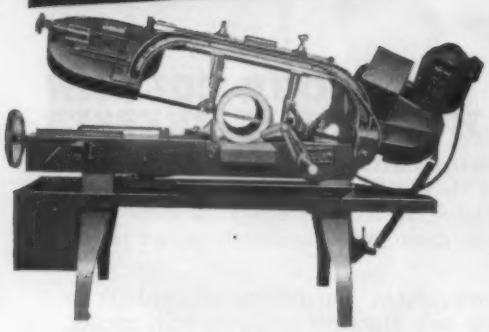
Get full details and complete specifications. Write for Bulletin No. 95.

HYDRAULICS DIVISION
K·R·WILSON·Inc.
ARCADE, NEW YORK, U. S. A.

METAL "CUT-OFF" becomes a preferred job . . .

with rugged dependable "WELLSAWS"





featuring . . .

- **Easily Controlled Operation**
- **Fast, Accurate Action**
- **High Job Productivity**
- **Low Operating Cost**
- **Long, Dependable Service**

● Production, or utility "cut-off" work in your shop becomes a *Preferred Job* with a Wells Horizontal Metal Cutting Band Saw, because the *operation* is so *easy to control.* Even in the hands of the "new guy," a Wells Band Saw can be counted on to *Reduce* your *Production Costs,* through greater efficiency, more accurate cutting and real dependable service.

Another important *"key"* to better cutting . . . *New Constant-Load, Fool-Proof Blade Tensioning Control* found only on Wells Saws. And, for *more job profit* . . . Wells-O-Bar Feed Master will convert Models 8, 800 or 1200 into automatic cut-off machines for duplicate cutting.

Big Jobs, or Little Jobs, there's a "Wellsaw" for every metal cutting job around your shop. Standard capacities from 3½" x 6", on the new 49A "two-in-one" saw, up to 12¾" x 16", on the 1200 Heavy Duty Unit. Special machines have capacities of 24" and larger for Extra Heavy Duty and Unusual Jobs.

Call your Wells Distributor, or write for *Job Engineering Service.*

Wellsaws

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 Roosevelt Rd. Three Rivers, Michigan

change are fought against but they push on with relentless persistency and the old systems yield to the new.

The old apprenticeship system had faults which are carried over in some of the training programs of the present day. The apprentice is sometimes looked upon as a source of cheap labor. The apprentice is sometimes assigned tasks totally unrelated to the trade he is supposed to be learning. A very common fault lies in the fact that the skilled workmen or foremen assigned to the duty of teaching the apprentice the trade were well acquainted with the trade but were unqualified as teachers. As a result of these faults the training period frequently takes longer than necessary. Attempts have been made to correct these conditions by training the men in a school. This plan had other shortcomings. The tendency was to equip the school with the smaller, older machines. The spirit of the students in a school is more likely to become that of careless learners rather than that of earnest workers. It was found that beginners tend to learn more quickly when they have an opportunity to associate with expert workers rather than other unskilled students. The school-room attitude is not the same as the shop attitude, and it is hard to instill shop attitude in school.

There are a variety of other training plans gaining in popularity. One which appears to have a great deal of merit combines school and shop training. The students alternately spend periods of from one to four weeks in the school and in the shop. This permits them to develop the shop attitude. It also offers ample opportunity for learning drafting and the theory behind their work in the shop. These are frequently regulated in training programs devoted exclusively to shop work. This combination type of program is a very flexible one and is being adopted by more and more organizations all the time.

L Becker
New York 21, NY

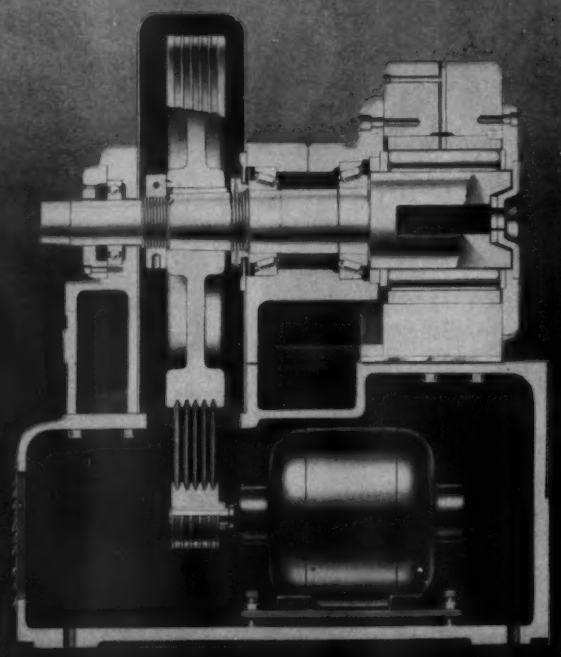
Names in the News . . .

James F Herslow, sales manager for Sillcocks-Miller Co, precision fabricators of plastics, has been named vice president of the Maplewood, NJ, company.

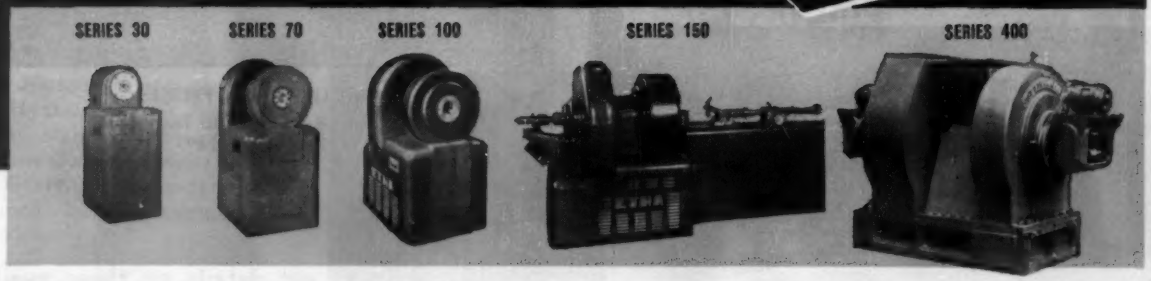
Kenneth W McKenzie, production manager of Industrial Tectonics, Ann

IF IT'S SWAGING... It's Etna..

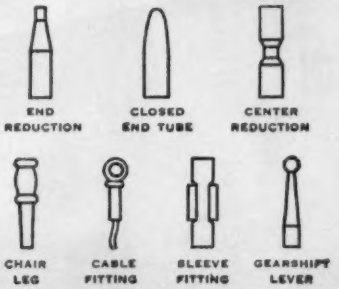
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

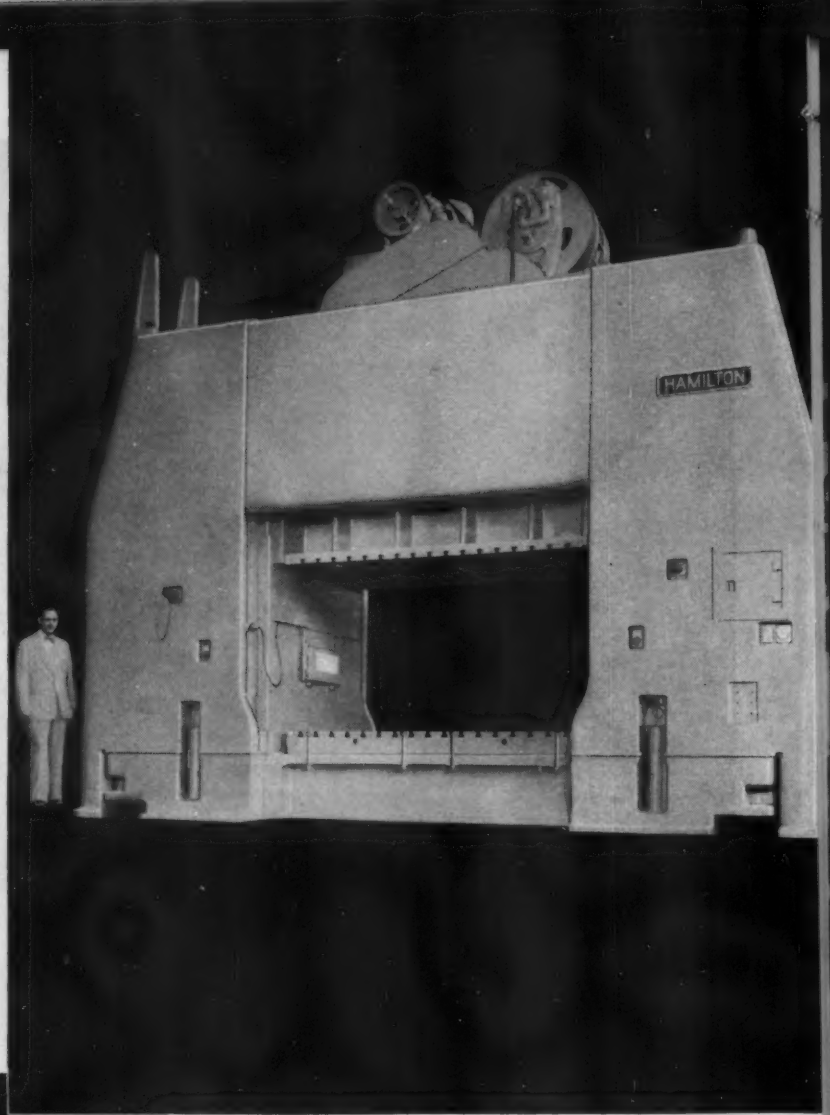
Abbey ETNA Company

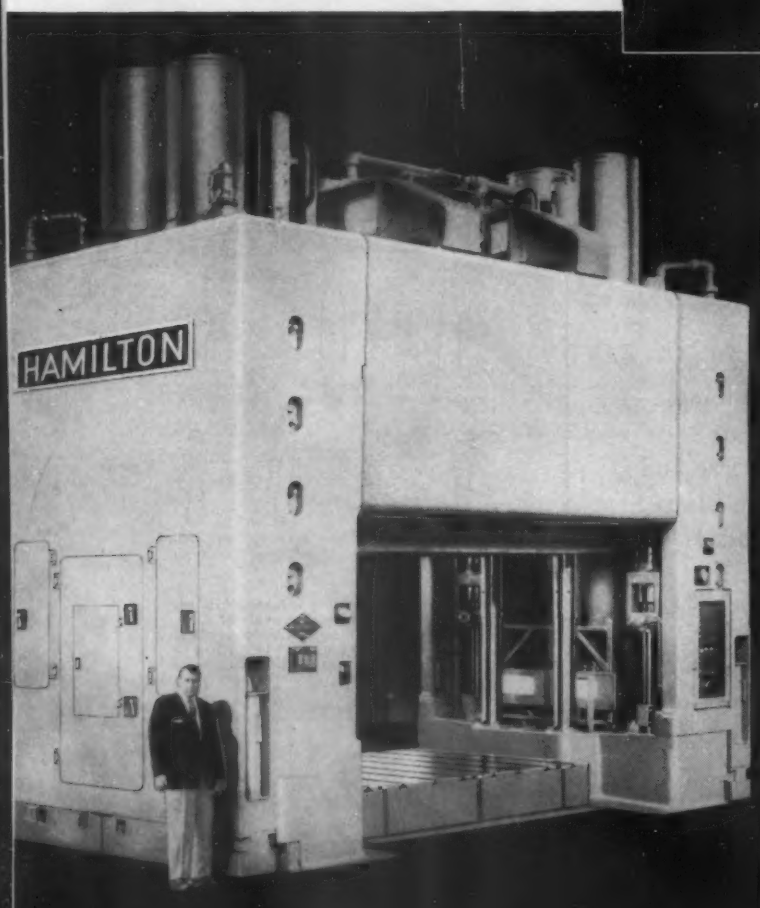
3404 MAPLEWOOD AVE., TOLEDO 10, OHIO

Hamilton Presses New Policy... Large Presses for IMMEDIATE Delivery

Now you can increase your productive capacity without delay. These Hamilton presses are in stock, as well as other single action, double action and triple action presses.

Hamilton's new unique policy of building these standard presses for stock means a sound investment for you. You'll profit by acting right away.





SINGLE ACTION PRESSES
450 Ton—84" • 600 Ton—108"
900 Ton—124"

Like to get details on these available presses? Just pick up your phone and call Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

BALDWIN · BLH · LIMA-HAMILTON

Hamilton Press Division

BALDWIN-LIMA-HAMILTON

DOUBLE ACTION PRESSES
400 Ton—60"

TRIPLE ACTION PRESSES
1600 Ton—108" • 2100 Ton—134"

Arbor, Mich, has been named sales manager. **Gerald L Burhman,** assistant production manager, has been appointed plant manager.

Joe Bungartz, West Coast field engineer for Cincinnati Milling & Grinding Machines, has been promoted to Western District manager.

Robert A Daggit, Northern Indiana territory field representative for Joseph T Ryerson & Son, Inc, has been named assistant manager of sales for the steel distributor's Chicago plant.

Richard A Ogden, treasurer and assistant to the president of the Permutit Co and its subsidiaries, has been, in addition, elected secretary.

W H Staples, president and treasurer of the Cleveland Hobbing Machine Co, has resigned as an active officer after 41 years' service with the organization. He will continue in a consulting capacity and as a director. **O E Staples,** executive vice president, succeeds his father as head of the firm.

George T Scharffenberger has been elected vice president in charge of operations of Kellogg Switchboard & Supply Co, a Chicago division of International Telephone & Telegraph Corp.

G Lawton Johnson, a vice president of Greer Hydraulics, Inc, has been elected, in addition, president of Greer Marine Corp, a subsidiary. **Edward M Greer,** GH president, has been named board chairman of Greer Marine.

Robert C Baumgartner, export manager of the Oster Manufacturing Co, Cleveland manufacturer of pipe and bolt threading machinery, has been appointed general sales manager.

James M Darbaker, senior vice president of Copperweld Steel Co, has been elected president; he succeeds **R S Kaplan,** named chairman of the board and chief executive officer.

Raymond J Dunn, Jr, sales engineer for Hartford Special Machinery Co, has joined the Machinery Engineering & Sales Co, manufacturers representatives, as vice president.

William N Rathbun, chief industrial engineer at Temco Aircraft Corp, has been named plant facilities engineer for the Dallas firm. **James F Parrish,** general supervisor, succeeds Mr Rathbun.

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Reduced production costs—result of the installation of ultra modern specialized equipment brings this great saving.
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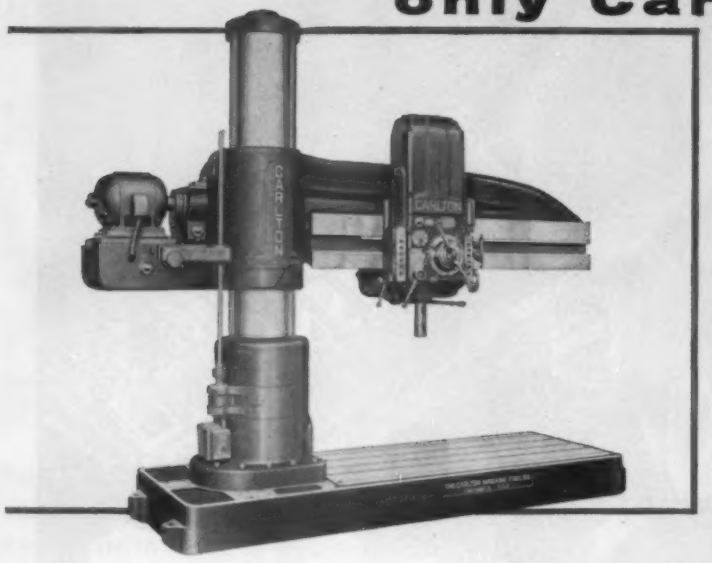
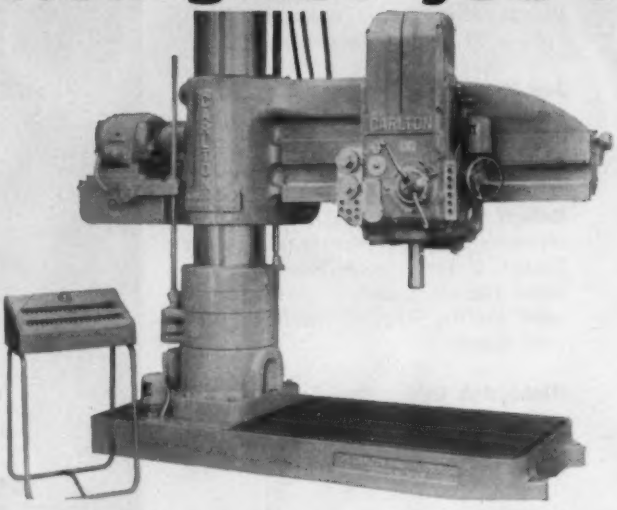




1. Programming and pre-selector gear shift sets up correct speeds and feeds for a complete sequence of operations.

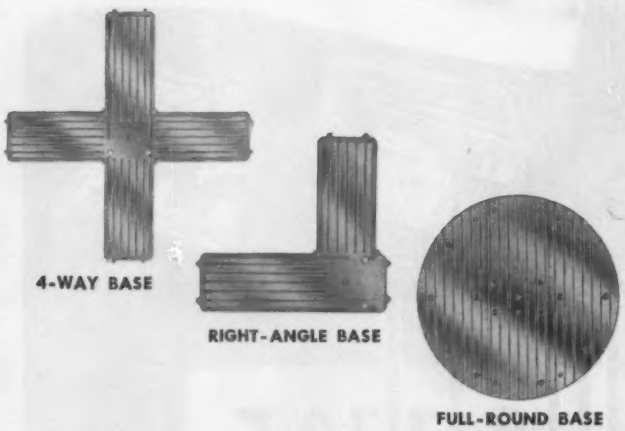
With the introduction of the new Carlton-Leber speed-feed programming and pre-selector systems, you can now take your choice of three speed-feed controls: programming, pre-selector or manual.

Programming works like this: your production engineering department studies the workpiece drawing and determines the sequence of drilling operations and the correct speed and feed for each. This data is recorded on a routing sheet or blueprint and is transferred to the programming console.

The programming console contains an indexing dial which shows the operation sequence number being performed. Operator has local control and can perform operations out of sequence by manually advancing or reversing the indexing dial.

Pre-selector: For less lengthy or complicated drilling jobs, the programming unit can be disconnected through a selector switch and the pre-selector then becomes operative. The pre-selector saves time by allowing operator to select speed and feed for the next operation while the machine is under cut. Pre-selector may be furnished with or without the programming unit.

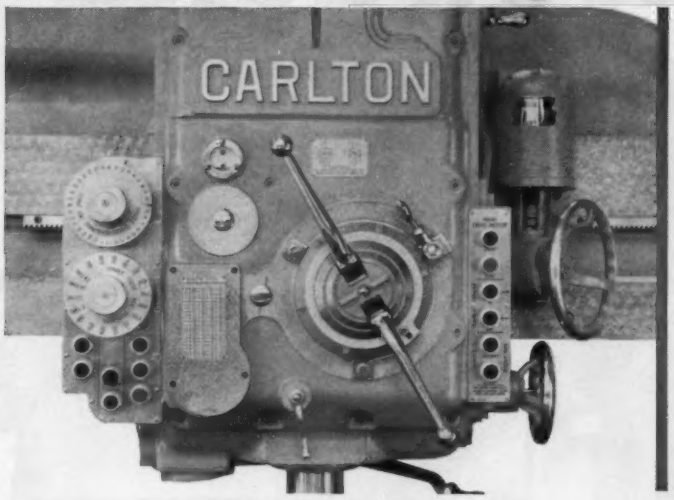
and special bases, tables and



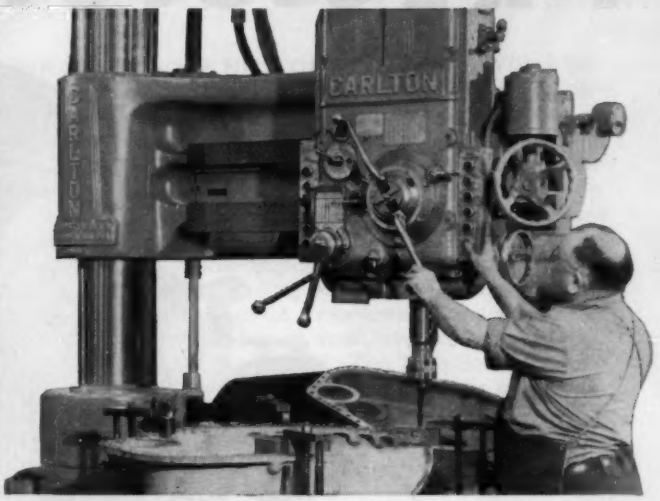
Special bases: Carlton radial drills can be furnished with any of seven different types of stationary bases (three of which are shown above). In addition, special track type mounting and sliding bed plate base also available.

Special tables: Plain, uni-tilt and full universal tables available as extra equipment. The universal table shown above is Carlton engineered and built, is fully universal and has a 32″ round top.

choice of 3 speed-feed controls



2. Pre-select gear shift: 1 speed graduated dial and 1 feed graduated dial pre-set speeds and feeds.



3. Manual gear shift: 2 shifter levers for controlling speeds, 2 shifter levers for controlling feeds.

Manual gear shift: Selects speed-feed combinations in the conventional manner—manually, one at a time, using two speed shifter levers and two feed shifter levers.

Carlton gives you a wide choice in radial drill selection . . . not only in speed-feed control systems, but also in size and capacity. You're sure to find your most economical drill size at Carlton, because the broad Carlton line includes arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. For the complete range of sizes, send for descriptive literature.

Carlton also gives you the advantage of a wide selection of special bases, tables and jigs and fixtures (see below). A capable sales-engineering staff will study your requirements and submit without obligation a recommended tooling set-up that's best for you.

Carlton has just published a new 24-page booklet presenting the most modern concept on how you can get better, more efficient, lower cost drilling. Why not write for your free copy today? The Carlton Machine Tool Co., Cincinnati 25, Ohio.

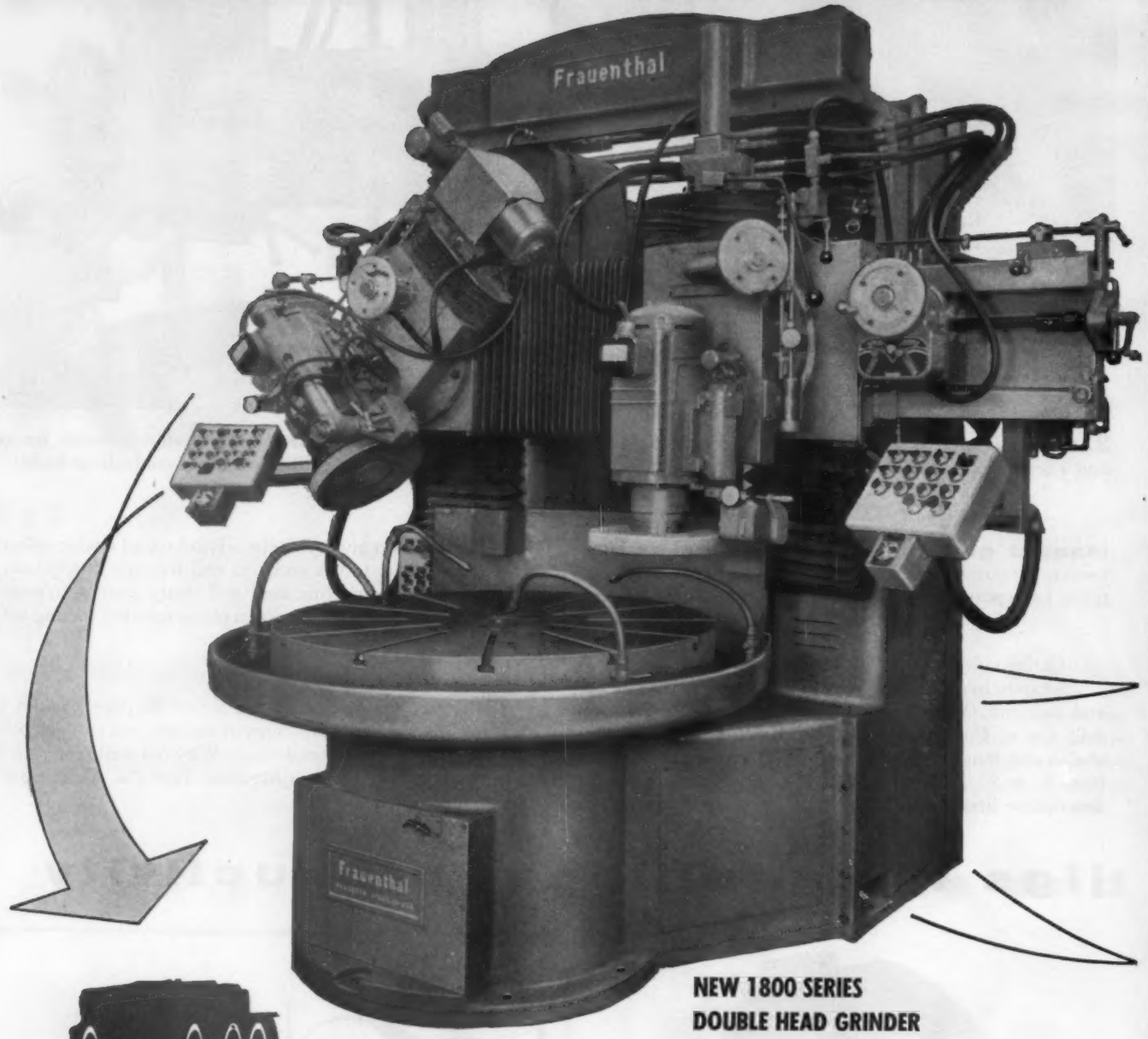
jigs for additional productivity

Special jigs: Carlton engineers will be glad to recommend the most efficient tooling for your requirements. The set-up shown above reduced running and set-up time from 7 hours down to 5.25 hours. Includes master trunnion, jigs and boring bars.

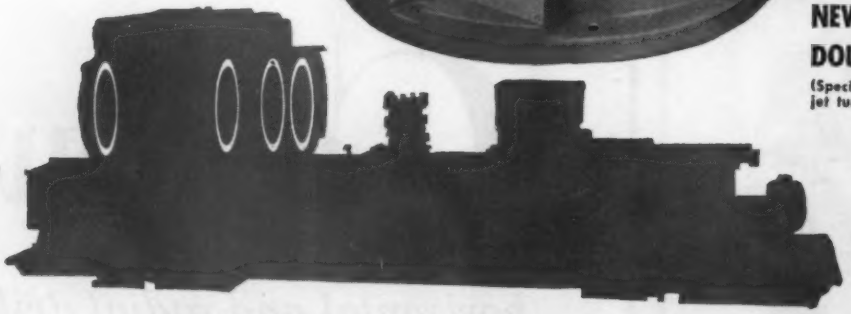
Carlton

horizontal and radial drills

PRECISION-GROUND



NEW 1800 SERIES
DOUBLE HEAD GRINDER
(Specially equipped for grinding jet turbine blades)



MACHINE TOOLS

Free Catalog!

For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.

Frauenthal Division

COMPONENTS . . .

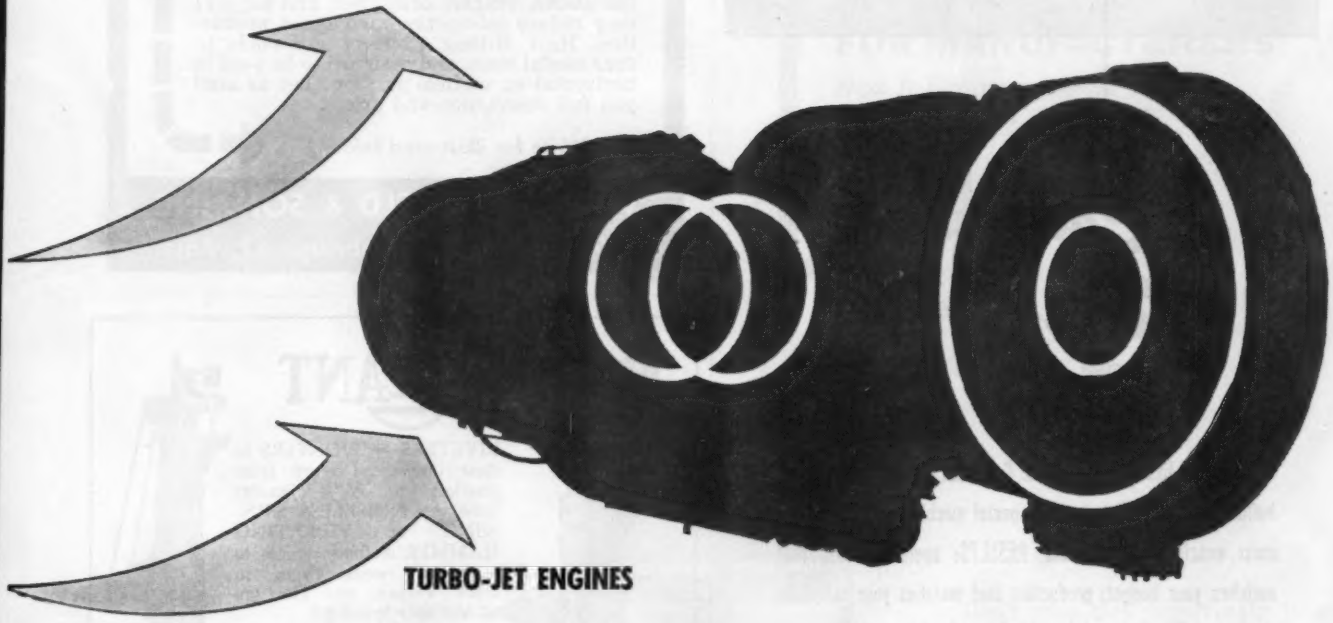
ORDNANCE

WHATEVER YOUR FIELD OF INDUSTRY — With Frauenthal precision machines, you're able to grind diameters and related surfaces without changing setup of the workpiece and obtain accuracies within .000200". This assures consistently uniform precision in concentricity, parallelism and roundness.

The accuracy and versatility of Frauenthal equipment is unequalled in the machine tool field. Difficult work-pieces — those impossible to handle on conventional horizontal grinding equipment — are handled with comparative ease on these unusual machines.

Four different series of machines are available affording table sizes up to 140". The 1800 Series Double Head Precision grinder, illustrated at left, is now available with a maximum swing of 72" and various table sizes to suit customer specifications.

For complete details, contact Frauenthal of Muskegon, Michigan.



TURBO-JET ENGINES

MACHINE TOOLS — Modern day machine tools are required to produce piece parts to greater accuracy than ever before. Therefore, machine tool components must be more precise to the nth degree. With Frauenthal grinders you can grind collets, chucks, spindle sleeves and similar components under simulated assembly conditions to assure concentricity, parallelism and roundness. Eliminate costly and time consuming hand scraping and grind plated parts prior to and after plating for increased wearability.

TURBO-JET ENGINES — Diffuser cases, rotors, compressor discs, vanes, etc., are components of jet engines ground on Frauenthal equipment. Thin section parts, which are unstable due to their design, are ground on the horizontal rotary table of the 1800 and 3100 Series machines. The compound and spindle angle setting features permit the grinding of surfaces normally inaccessible on conventional equipment.

ORDNANCE — Large bearings and housing components for ordnance applications are ground on the 1800 and 2200 Series grinders. Applications vary from aircraft gun turret bearings to the large turret bearings required for tanks, motorized gun carriages, radar and naval gun mounts.

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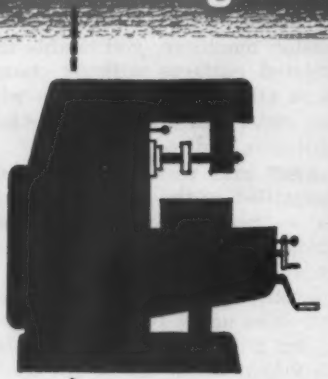

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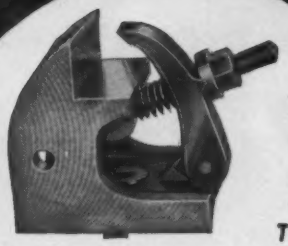

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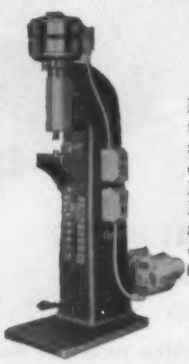

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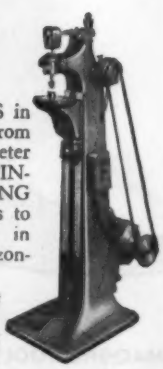

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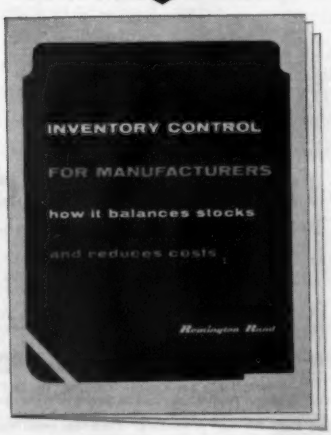
How It Balances Stocks And Reduces Costs



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Don't miss this opportunity to get the full picture of what Inventory Control means to Management, Production, Purchasing and Sales. Upon inventory availability and adequacy depend scheduling, workflow and delivery – even such human factors as job stability and good labor relations. Inventory Control is the backbone of all manufacturing operations.

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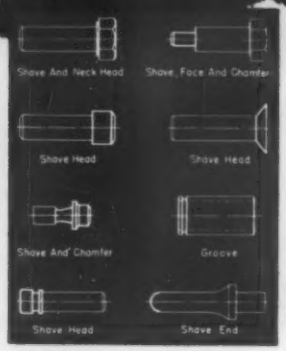
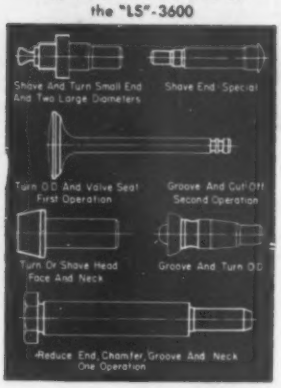


Typical parts machined on the "LS"-3600


Shave And Turn Small End And Two Large Diameters
Shave End-Special
Turn O.D. And Valve Seat First Operation
Groove And Cut-Off Second Operation
Turn Or Shave Head Face And Neck
Groove And Turn O.D.
Reduce End, Chamfer, Groove And Neck One Operation

Illustrating operations completed on the S-4300

ECONOMY Automatic Shaving Machines are designed to perform facing, turning, grooving, necking, cut-off and burnishing operations on bolts, automotive valves, projectiles and similar parts.

They are available in two sizes—the "LS"-3600 for body diameters up to 1/2" and lengths under heads from 1/2" through 4-1/2"—the S-4300 for body diameters up to 1" and lengths 3/4" to 6" under heads. Production rates for the standard "LS"-3600 range from 800 to 2400 finished parts per hour and the S-4300 from 450 to 1800 per hour.

Machines are fully automatic and parts flow from hopper to work pan. Simple adjustments plus easy, rapid set-ups enable operator to operate several machines.

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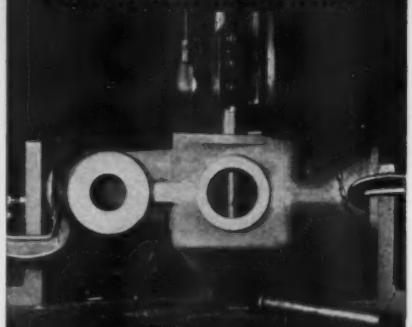

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It covers every step—from setting up a job, to tearing it down—giving the specific time value established for each element. The various non-machining operations which enter into the cost of any job are also given. Instructions are provided for the use of several methods of estimating particular jobs on each type of machine in use today.

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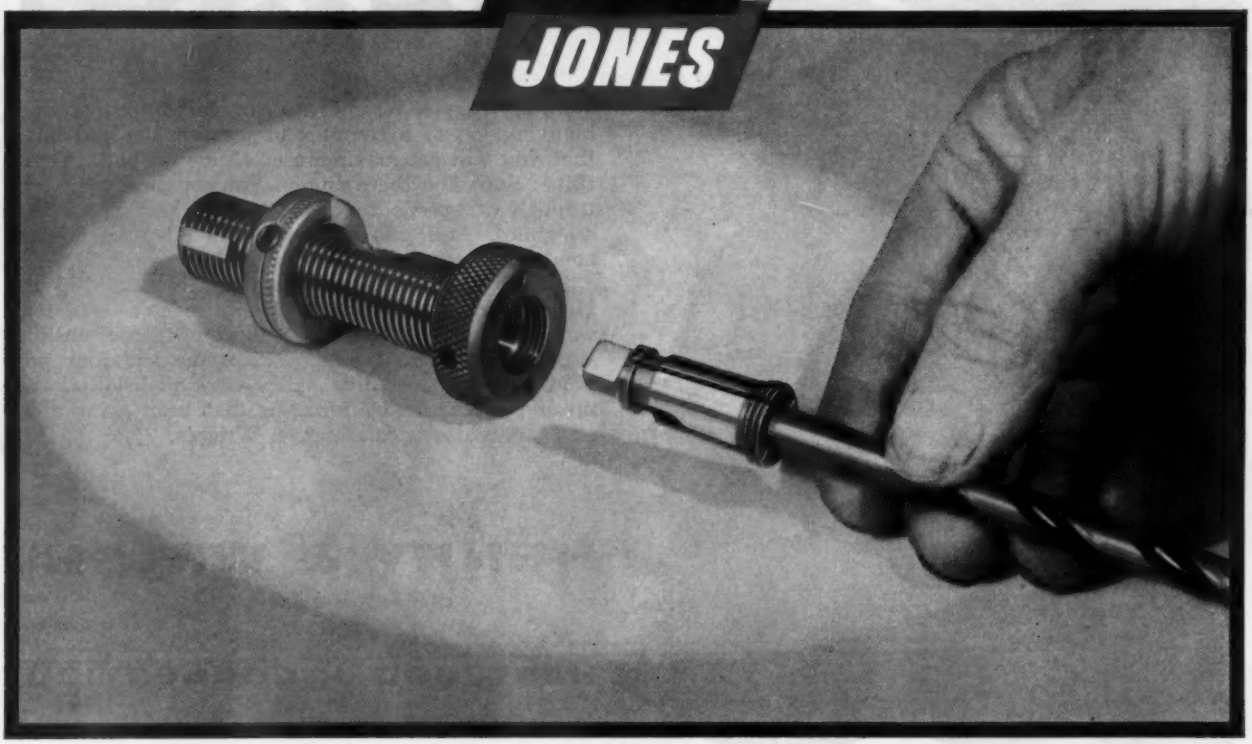

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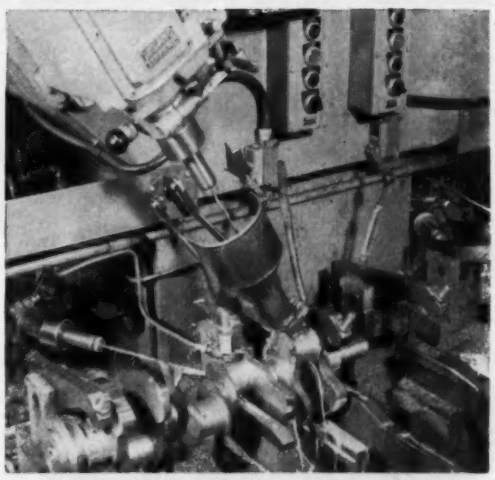

Lock-and-eject adjustable adapters speed tool changes, assure holding power and accuracy.

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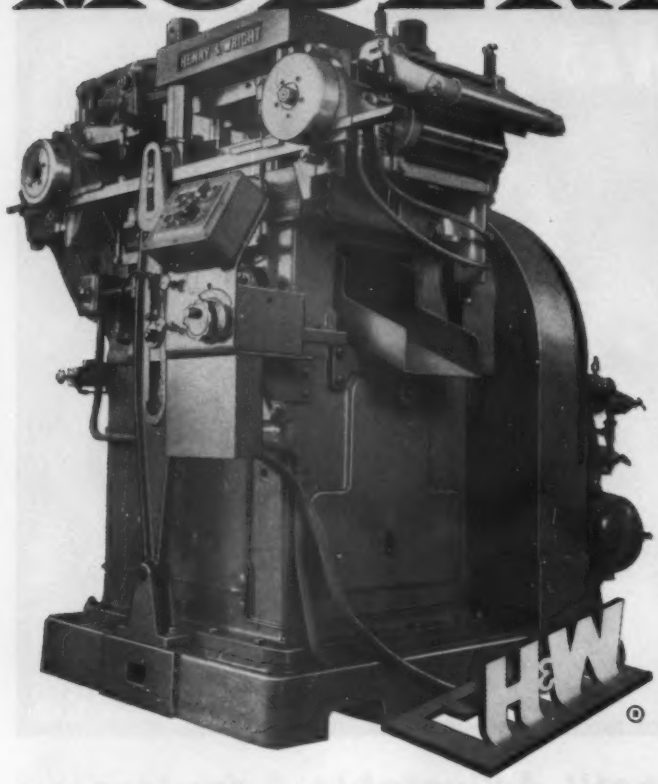

With a Henry & Wright you can shift from a straight blanking job to a complex progressive die and know that you will get maximum efficiency on both. Versatility? Sure. But there's more. You can push those jobs through at speeds to meet the toughest production schedules. And you can effect die changes quickly enough to make even short runs less costly.

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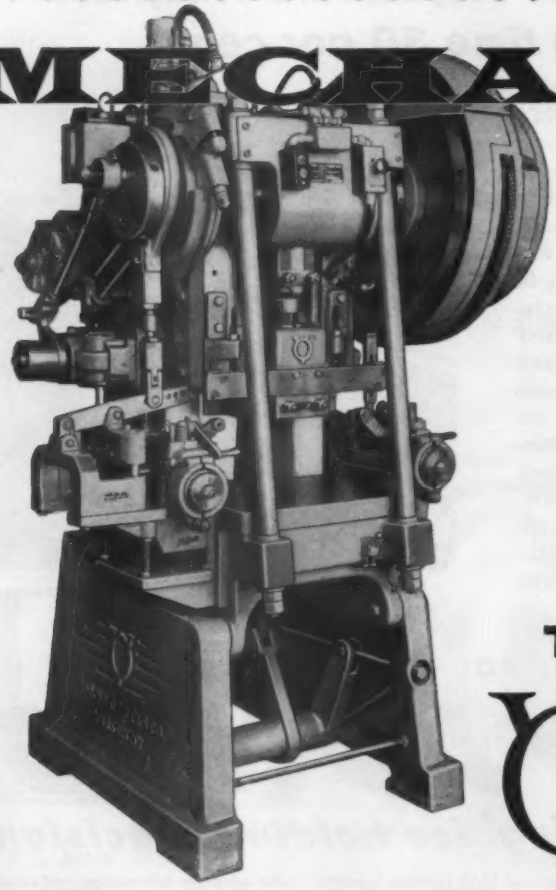

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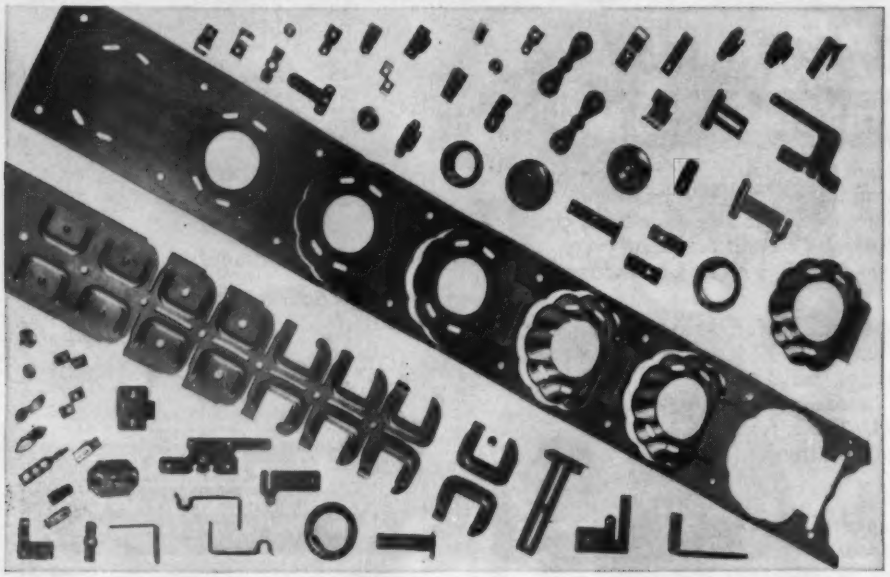
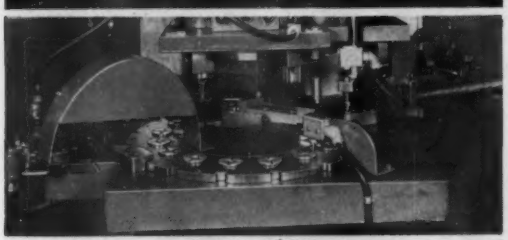
Each of the parts shown below was produced complete-per-stroke from coil stock. Work quality through the steps in the progressive die is thus subject to only two variables—the precision of the die and the care with which it is set. You can control these. The precision of a Henry & Wright does the rest.



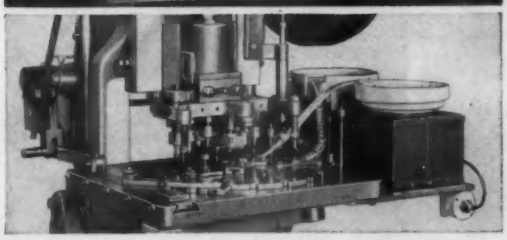
LOOK WHAT YOU CAN DO WITH A

V & O PRESS

Model 50S V & O, using an 18 station dial feed and a five station progressive die, makes outer housings for ball bearings.



Set up here produces finished piece, using slide and dial feeds with blanking, forming and piercing dies.



This equipped V & O press has two hopper feeds synchronized with a dial feed and multi-station progressive die.

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Grant Speed Reducers

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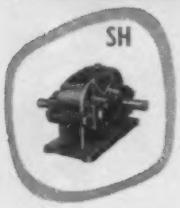
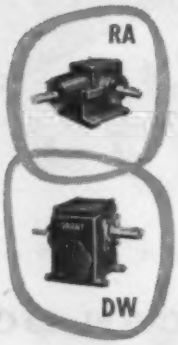


The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

What's back of such performance? Extra-quality features built into each Reducer, by gear experts . . . totally enclosed cast iron housings, radial thrust ball bearings, precision high-test bronze gears and worms of chrome vanadium steel. These features mean money in your pocket through trouble-free operation.



Grant manufactures a complete range of types and sizes — worm, double worm, compound worm and spur, helical and mitre gear — with reductions up to 3660-1 — most available from stock. Write for the latest catalog, describing each type in detail.

AGMA

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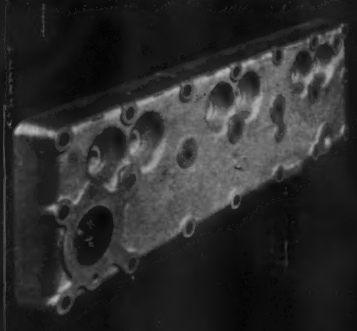

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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged *89.5%* greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE... because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

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That so-called "suitability" is a combination of proper design and appealing price. As *you* well know, design and price depend on the method of fabrication and its cost. And suitably enough, Reynolds uses Sciaky Resistance Welding to produce those frames.

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Production limitations, high operating cost, and greater maintenance requirements make these "antiques" expensive to own. You can't be competitive if the cost of your product won't let you compete.

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"Resistance Welding At Work," Vol. 4 No. 7, details the Reynolds story. Write today for your free copy of this dramatic proof of Sciaky basic design thinking—welders to do *more useful work* at *lowest operating cost* with *maximum reliability.*

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HOW 6 MAJOR INDUSTRIES NOW CUT *Product Costs*

1 AIRCRAFT TUBING—Smooth, extra sharp bends now produced in ultra-thin stainless steel tubing, saves space and $14,000 per plane for aircraft manufacturer. Shown above, Pines Size 4 Unit forming wrinkle-free 8" c/l radius bend in 4" x .020" S. S. tubing.

2 HOLLOW TRACTOR BOOMS—Cold bending 12 ga. welded steel tapered tubes without distortion on Size 4 Pines unit eliminates expensive blanking and forming dies, saves tons of material for farm equipment manufacturer.

3 EXTRUDED WINDOW FRAMES — Part of production line setup in large aluminum fabricating plant, this small Pines Semi-Automatic saves space, accurately bends automobile window frame moldings.

4 REFRIGERATION AIR CONDITIONING ELLS — Special Pines Automatic Cut-Off Benders now produce copper ells and return bends at speeds up to 1500 per hour, reduce scrap losses to 1%.

5 ENGINE MANIFOLD TUBES—Short 1½" O. D. steel tube now bent to 1½" c/l radius with flange attached saves space, insures accuracy, cuts costs.

6 BOILER TUBE AND REFRIGERATION COILS—Typical setup bending continuous serpentine coils from ⅜" steel tubing. Reduces welding, fabricating costs. Other installations range from ¼" copper up to 3" steel tube.

with PINES PRODUCTION BENDERS

The examples shown here are a few of the countless number of production jobs that are now handled efficiently and more profitably on Pines Automatic Benders. They illustrate the versatility and the many cost-cutting advantages of cold forming round, square, rectangular, extruded, or hollow stock the "Pines-Way". Simplicity of tooling, uniform accuracy, and ease of operation are proven features of Pines machines which today help hundreds of plants cut product costs. At Pines you'll find an unmatched wealth of bending experience and creative tooling skill readily available to help you develop better methods and save time on production problems.

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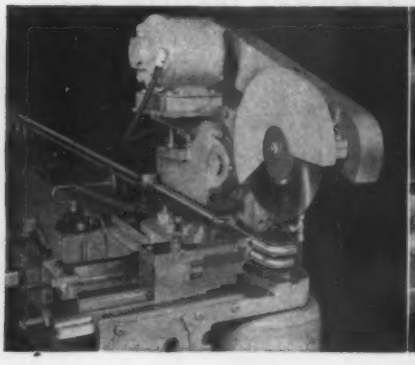

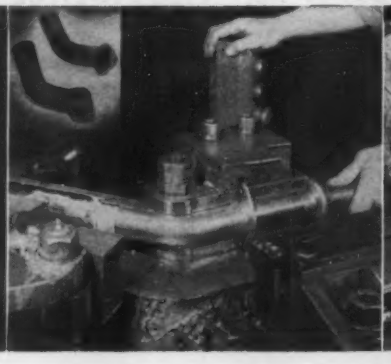

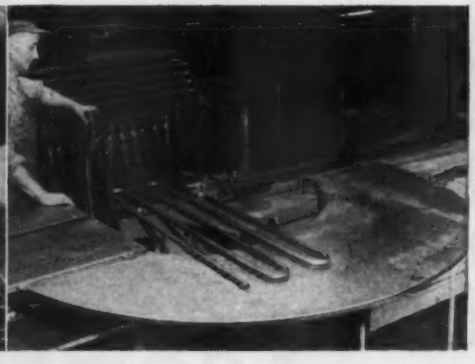

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1. **How can I electroclean steel at lower cost?**
2. **How can I find a brass cleaner that gives better protection against tarnishing?**
3. **How can I reduce rejects due to faulty electrocleaning of zinc die castings?**

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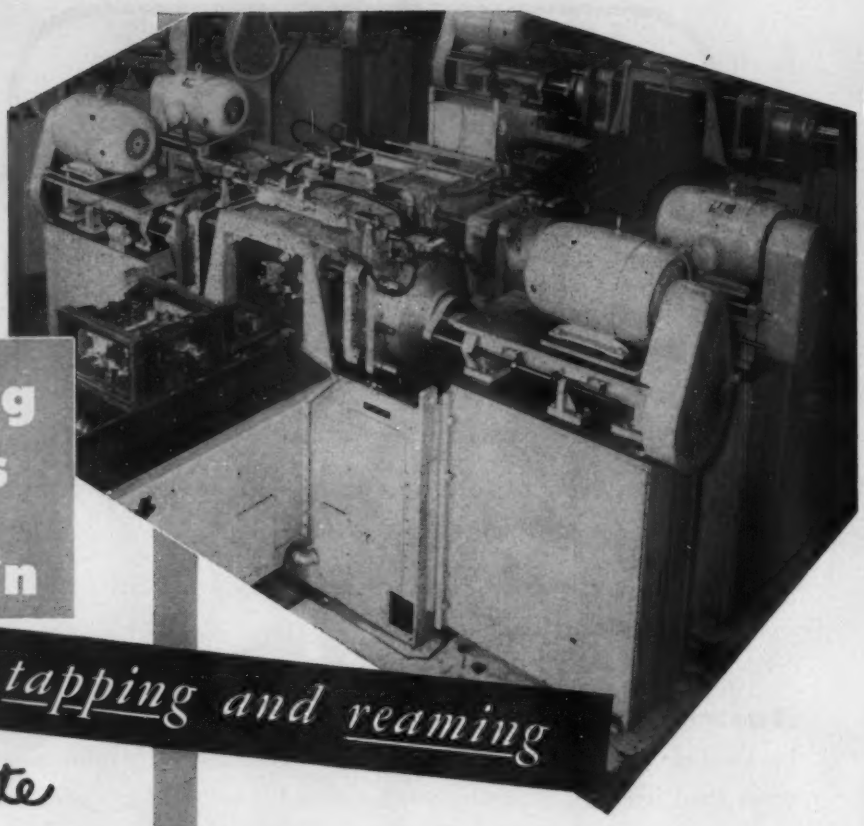

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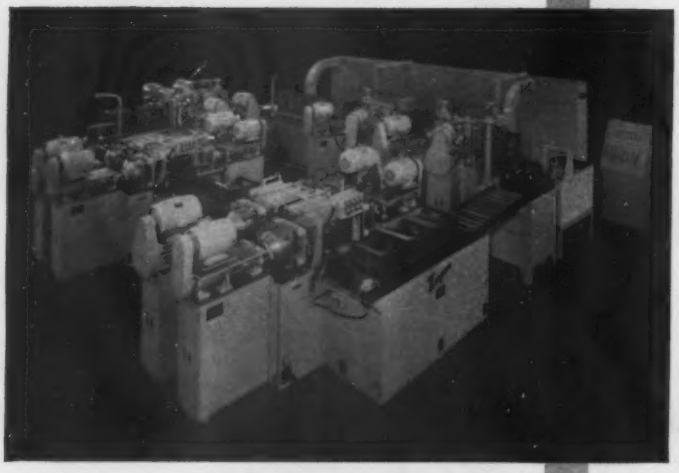

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SpeedKut A is a product of Stuart's sulphochlorination processing that provides absolute uniformity and stability. Highly effective chemical additive materials are pre-balanced under strict laboratory supervision to instill SpeedKut A with the anti-weld and friction reducing characteristics necessary to the range of machining operations for which it is recommended.

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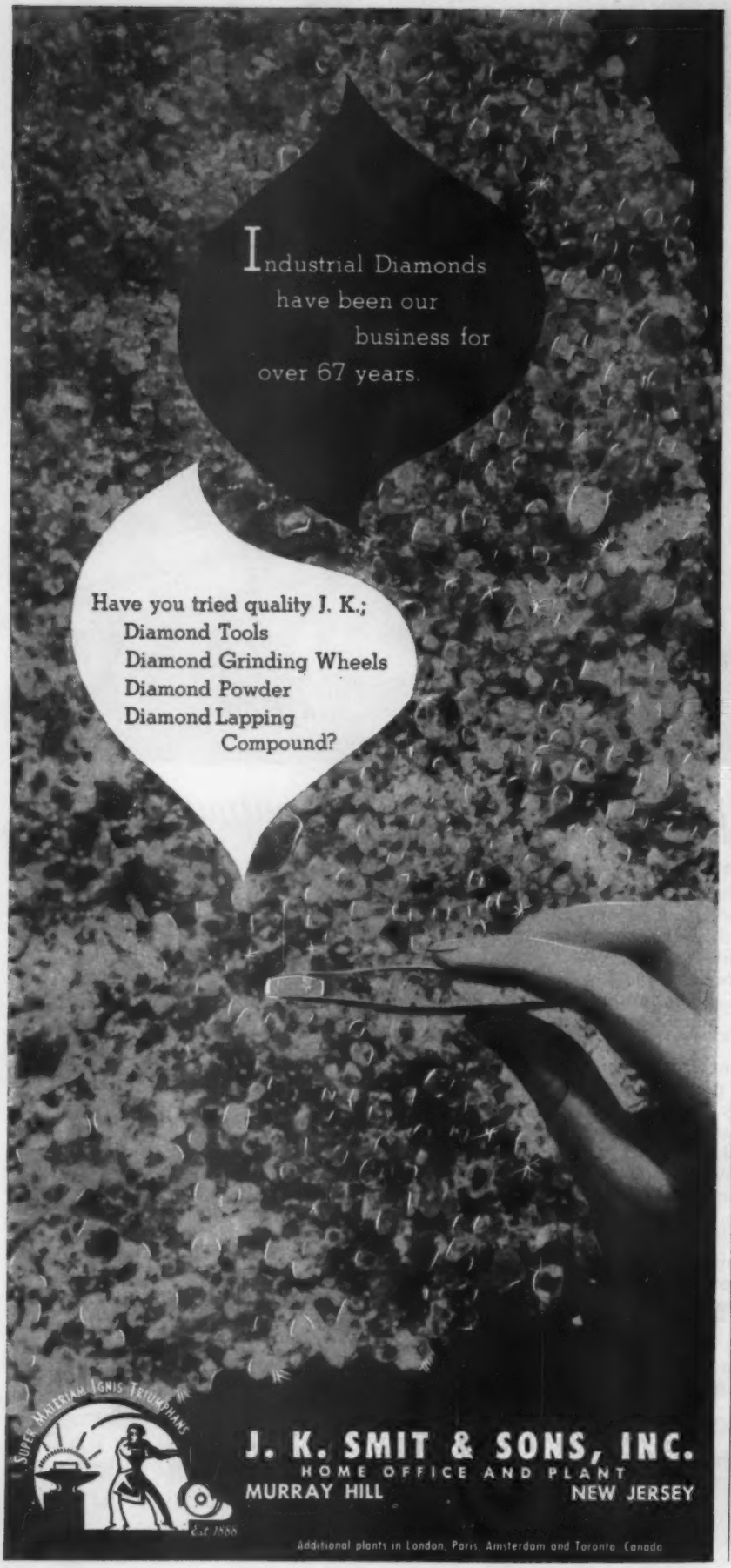

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Technical-ities

By John S. Davey

Coarse Threads Better Than Fine For Many Jobs

The load and stress concentrations on threads are lower in standard coarse thread fasteners than in fine threaded ones. Flank engagement is also greater because coarse threads are deeper. Except in such cases where fine adjustments are needed, coarse threads are, therefore, preferable to fine threads. They have greater resistance to stripping and, consequently, can be more highly torqued to make a stronger assembly.

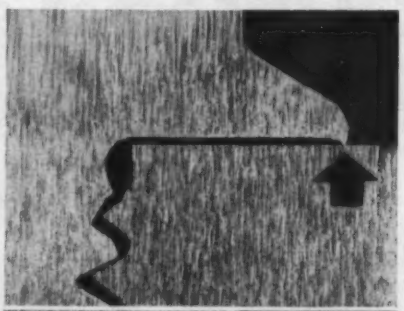
PRODUCTION SAVINGS

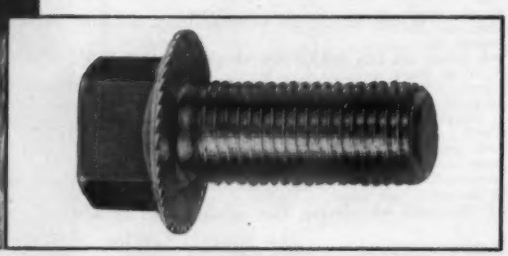
Coarse thread fasteners tighten with only two-thirds the revolutions needed for fine threads. So your assembly time is faster, too. Coarse thread bolts enter nuts or mating holes with less tendency to cross thread when not truly positioned. In hard-to-reach areas, this ease of starting can often be your deciding factor. Bear in mind, too, that coarse threads need less "babying" in handling since they're less apt to be damaged.

All in all, coarse threaded standard fasteners prove best for an assembly because of their additional clamping strength—and best for the assembler because of their extra economy and production advantages.

Spin-Lock screws increase holding power by 20%

EXPERIENCE confirms that Spin-Lock screws hold tight under conditions of vibration or repeated heating and cooling. Their strong teeth have a ratchet action on the bearing surface—the acute angle lets the screw tighten fast and easily, until the teeth actually embed into the seat upon tightening, as shown in the sectional photomacrograph below. The almost vertical face of the teeth then resists counter-rotation and loosening. As a result, it takes about 20% more torque to loosen a Spin-Lock than to tighten it.





LOWER COST ASSEMBLY

Spin-Lock screws avoid need for washers or external locking devices. One-piece construction, they allow faster assembly and can be easily handled and driven in cramped spaces.

STRONGER ASSEMBLY

Heat treatment gives the teeth hardness and toughness. Spin-Lock screws can, therefore, be reused when removed with but slight loss in holding power. The extra strength also permits tighter fastening for a stronger assembly without risk of stripping threads.

Screws with hex, pan, truss and flat heads are available. See Sweet's Product Designers file or write Russell, Burdsall & Ward Bolt and Nut Company. Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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A mechanical vibrating shaker naturally suffers severe abuse itself from vibration. One manufacturer of such machines used costly special fasteners and lock nuts to control tendency of the product to loosen up.

Asked about it, RB&W recommended a standard high strength bolt, heavy nut, and two hardened washers. These permitted a high tensile clamping force to be developed. Residual tension was ample for the most severe operating conditions and kept the bolts tight. Result: A 25% saving in annual fastener cost, the constant availability of standard items, and less maintenance for the product. You too can draw on RB&W experience for technical help to assure a strong assembly and to cut costs.

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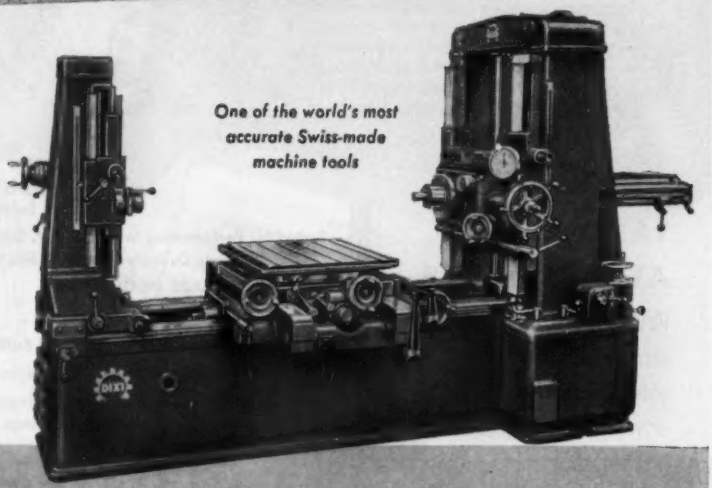

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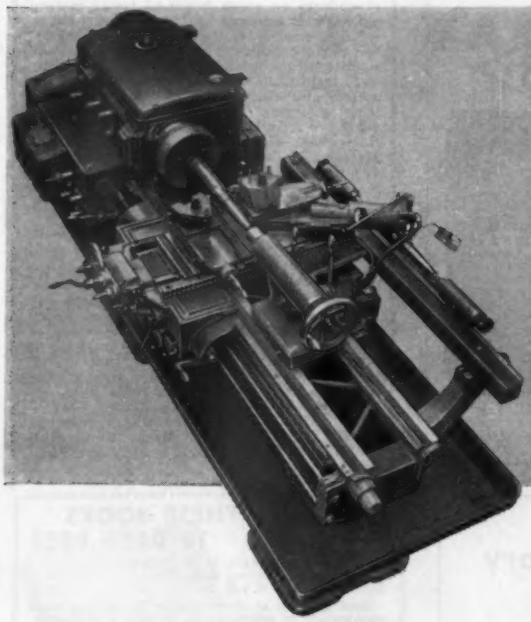

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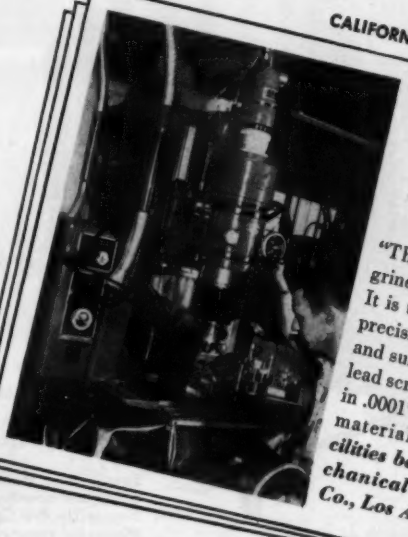

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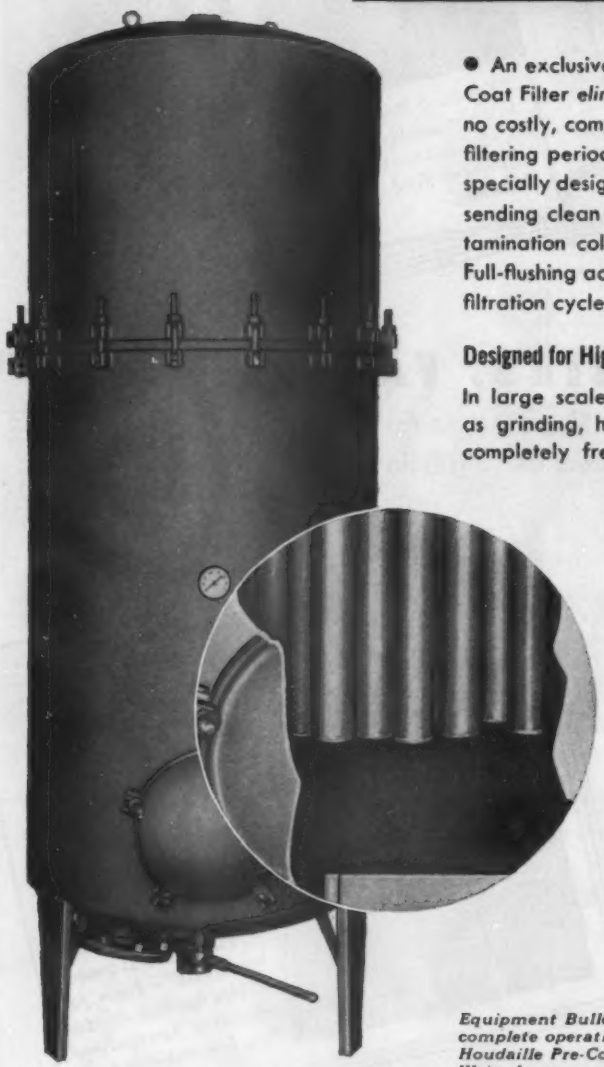

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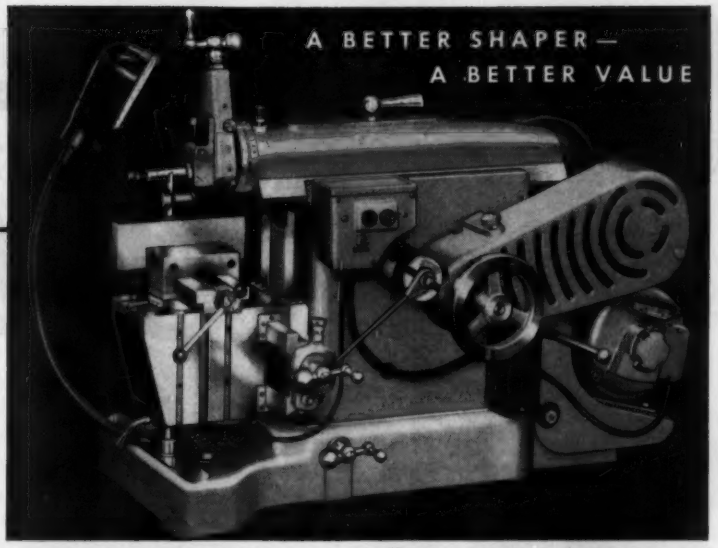

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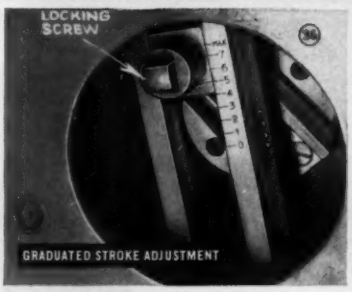

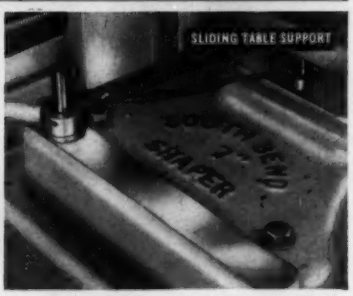

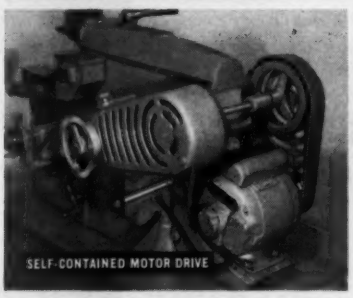

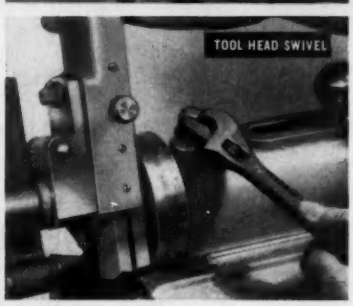

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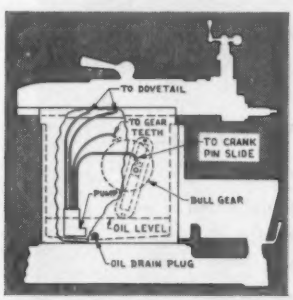

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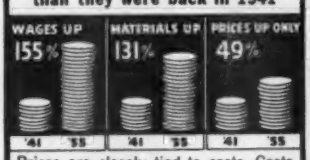

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up to 2 inches

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FEATURES AND ADVANTAGES

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- Micrometer adjustment for final sizing of work
- Simple, precise matching device
- Extra-heavy die spindle units
- Wide range of die and cam speeds
- Large clearance for shoulders on work
- Coolant tank removable for cleaning
- Drives and controls readily accessible
- Convenient kneehole for operator
- Easy to set up and change from one size to another
- Adaptable for thru-feed rolling
- Electrical equipment to J I C Standards
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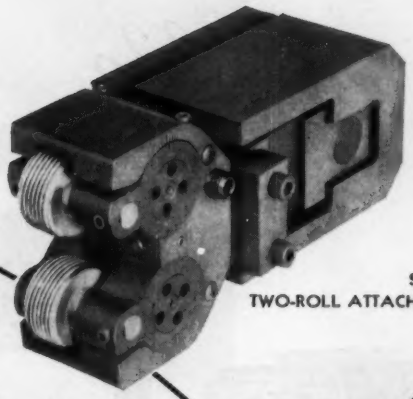
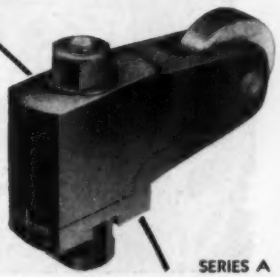
FOR AUTOMATIC SCREW MACHINES



SERIES B
TWO-ROLL ATTACHMENTS

SERIES B—TWO-ROLL ATTACHMENT

Reed's new improved Series B Thread Rolling Attachment is a multi-purpose precision tool utilizing two rolls. Rugged in construction and simple in adjustment, it is easy to set up and capable of rolling Class 2A and 3A threads. Currently built in four standard sizes, the Attachment can be used on over 100 different single or multiple spindle automatic screw machines in more than 300 cross-slide applications.



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SERIES A—SINGLE ROLL HOLDER

Available in six different sizes for use on single spindle automatic screw machines. Standardized Thread Rolls carried in stock.

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A23, Diameter Capacities
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Other

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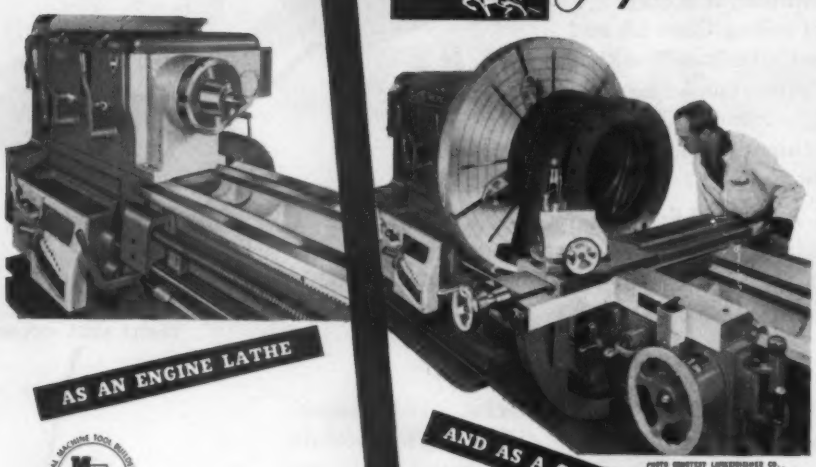

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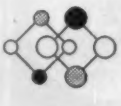

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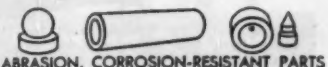
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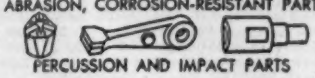
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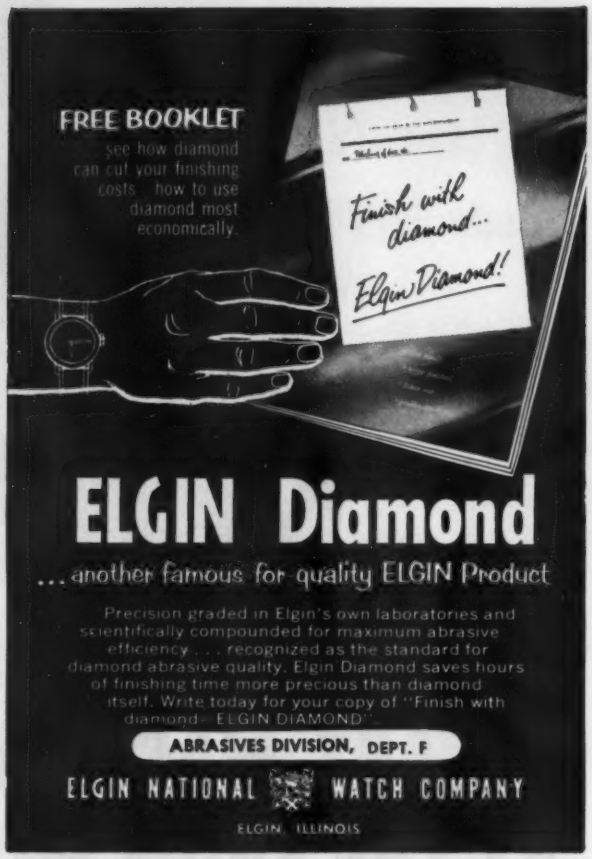
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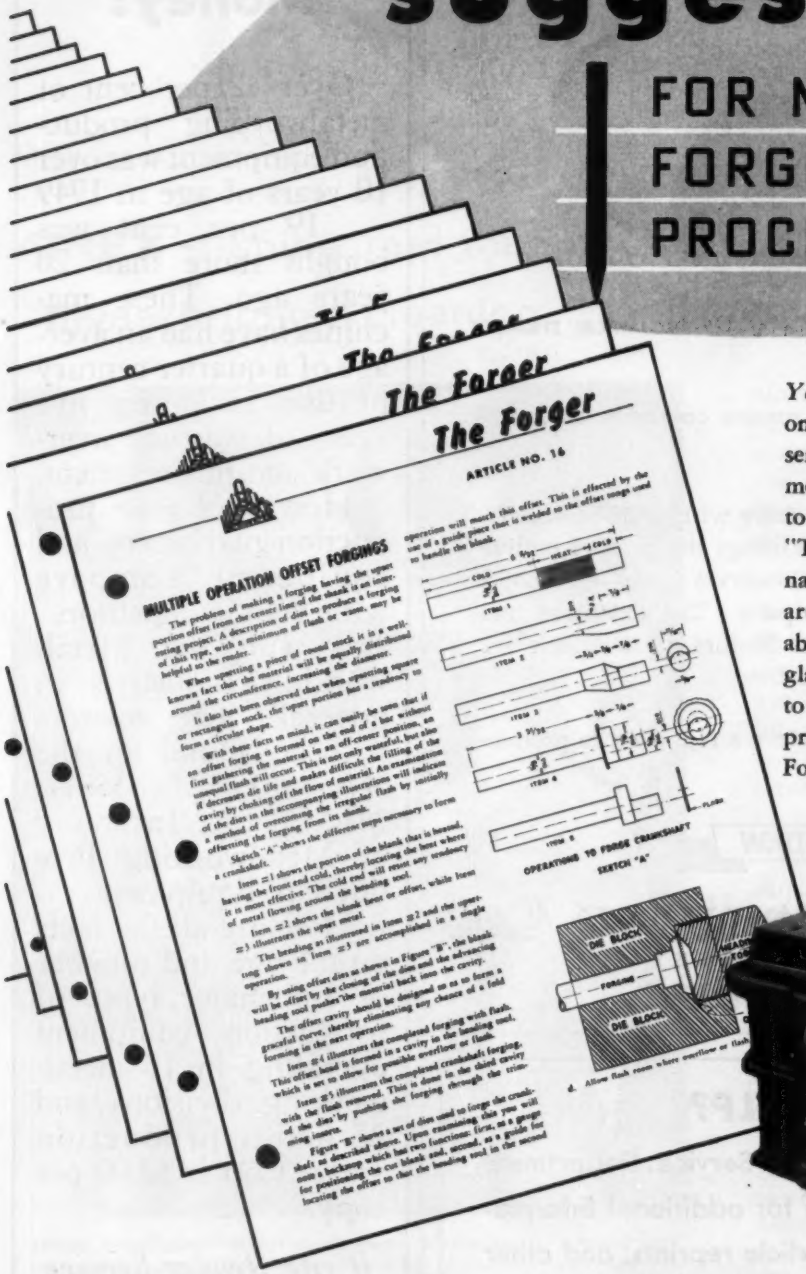

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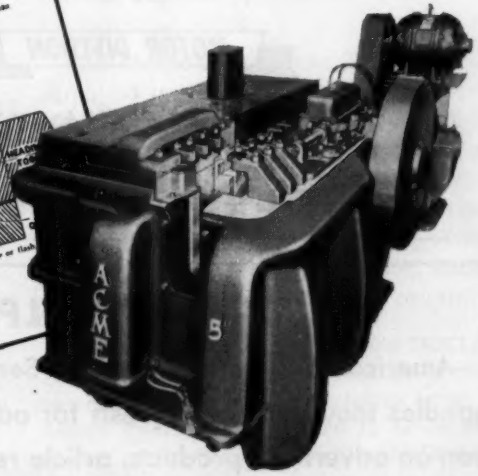

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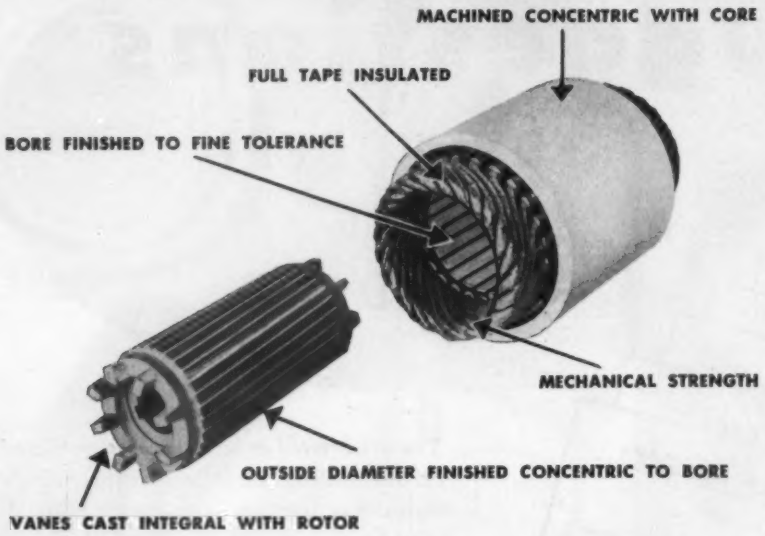
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The application of direct motor drive with WOODS' Shaftless Motors to high-speed spindles brings the peak of motive efficiency at relatively small cost. Conserves space—eliminates belts and gears—fewer wearing parts. The extensive and varied lines of WOODS' Shaftless Motors are available for nearly every class of direct application.

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Over 42 per cent of metalworking production equipment was over 10 years of age in 1949 . . . 19 per cent was bought more than 20 years ago. These machines have had an average of a quarter century of use, including five years of wartime overwork and mistreatment.

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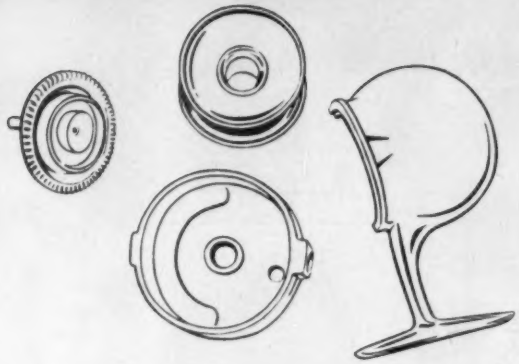
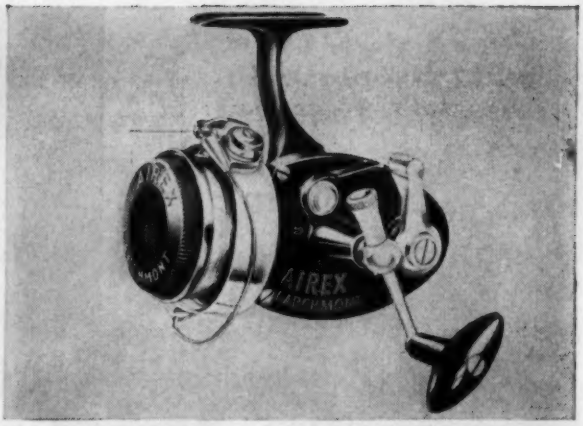
Another field report on "TRICLENE"® D





HIGHLY POLISHED PARTS of the Airex spinning reel are made from five different metals. To clean them all quickly and thoroughly takes just a single degreasing operation with All-Purpose TRICLENE D.

AIREX–fishing reel manufacturer–finds: TRICLENE® D gives brighter cleaning... cuts degreasing time in half

BRIGHT, THOROUGHLY CLEAN aluminum-zinc die castings are removed from the vapor degreaser at Airex Manufacturing Co. TRICLENE D is used by Airex to give fast, efficient, trouble-free degreasing.

Airex Manufacturing Co., of Hillside, N. J., uses parts made of five different metals in its popular spinning reel—aluminum, brass, copper, steel and zinc. Many of the parts are highly polished. Originally, some degreasing operations had to be carried out twice to assure thorough cleaning.

When Airex changed to TRICLENE D trichlorethylene, they substantially cut their degreasing time. *In a single operation,* Du Pont's efficient new solvent gives them the thorough, safe, trouble-free degreasing they need. And TRICLENE D cuts maintenance costs, too: Adjustment of solvent pH is no longer necessary... and the time between degreaser cleanouts is now six to eight weeks instead of two.

Locked-in stabilizers give TRICLENE D unsurpassed resistance to *all* major causes of solvent deterioration—heat, light, air, acids and aluminum chloride—yet this rugged solvent contains nothing to harm even delicately machined metal surfaces. TRICLENE D retains its original high purity longer . . . continues to give *brighter cleaning of any metal,* job after job, distillation after distillation. And remember, it costs no more!

FOR MORE INFORMATION about TRICLENE D and how it can bring a new standard of efficiency to your vapor degreasing operation, write to the nearest District Office of the E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

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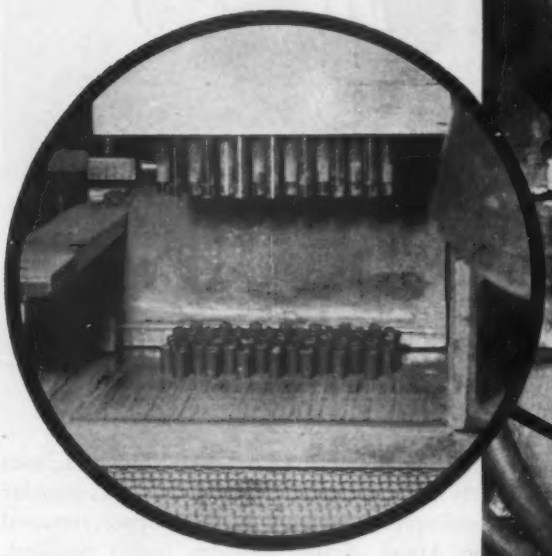
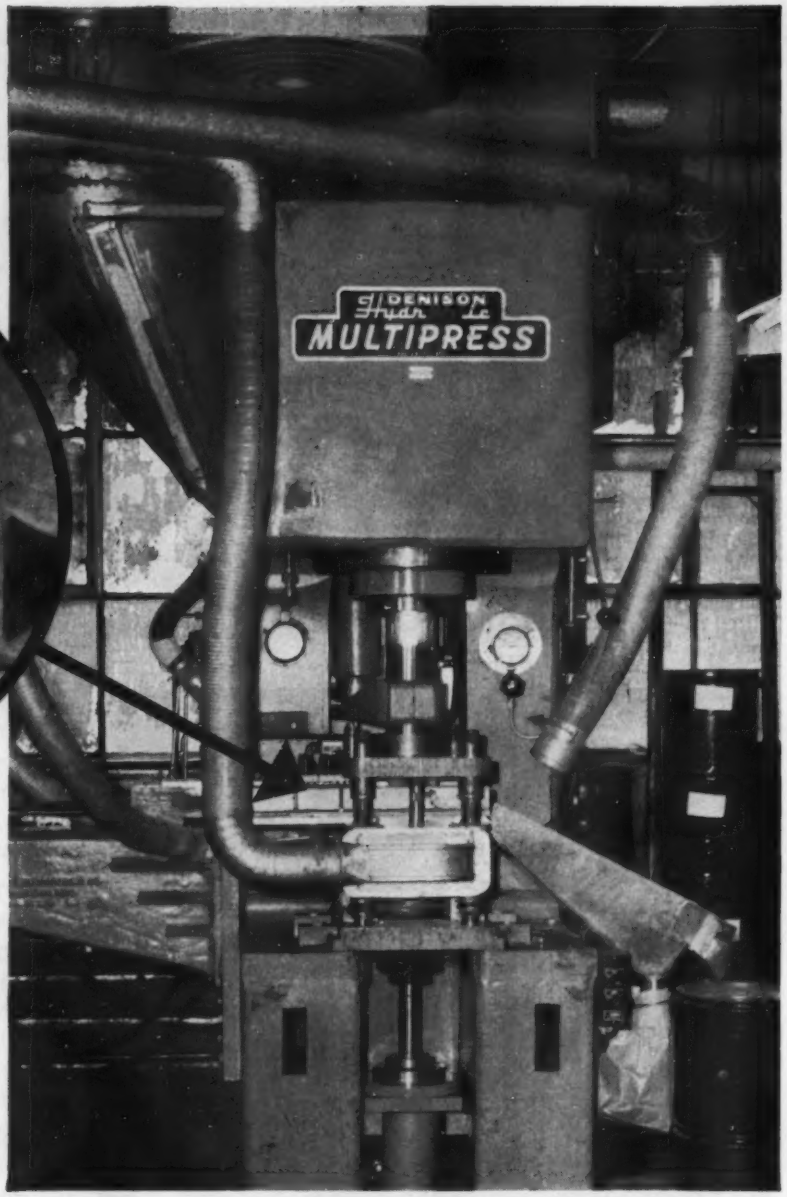


...automatically with DENISON MULTIPRESS®

an idea that simplifies many compaction jobs ...to save you money



52 TABLETS PER CYCLE coming off multiple-cavity die after compaction on Denison hydraulic Multipress. Tablets come down chute, are collected and coated.

52 tablets compacted with every ram cycle add up to 40,000 tablets an hour. That's what's turned out on a Denison hydraulic Multipress at this leading pharmaceutical company.

The entire operation is automatic. Results are uniform, cost is low.

Hoppers feed powder to a Denison Shuttle Feed Accessory that loads a multiple-cavity die. Two rapid, precision pressure controlled strokes of the Multipress ram compact the powder into tablets.

Many operations of compacting powdered materials can now be done faster, simpler . . . at substantial reductions in cost with Denison hydraulic Multipress and accessory equipment. Have a Denison Engineer study your operations and demonstrate how. Write.

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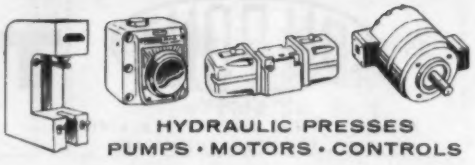
DENISON Hydr OILics



HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

Machining costs are 25% lower

This valve is used for a fuel return regulator check. Although the manufacturer was one of the first to use Carpenter Stainless No. 8 (Type 303) when it was first introduced, there have been occasions and conditions which required the use of ordinary makes of Type 303 Stainless Steels. The customer reports: Carpenter No. 8 *consistently* enables them to show a 25% saving in machining costs because of its constant uniformity and easier machinability.

Reject rate is reduced

An important requirement of this valve is that it be "leak-proof" in operation under pressure. To assure a tight seal, some surfaces are machined to a 5 or 10 micro-inch finish with tolerances as close as .0005". Because of the machinability and finishes obtained with Carpenter No. 8, rejects always take a sharp drop when compared with competitive Type 303 Stainless Steels.

Machine operators are happier

Here's an interesting sidelight: Machine operators can always spot an ordinary Type 303 without being told, because of the way it cuts in the machines. With Carpenter No. 8 they tell us they *know* the job will run smoother and faster with improved results. The same thing can apply in your *own* plant. So if you're looking for a way to improve performance and reduce costs on your stainless parts, CHANGE to Carpenter No. 8. See what the difference can mean to you.

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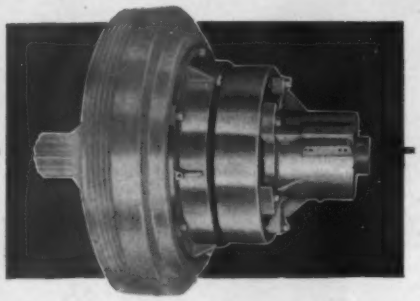
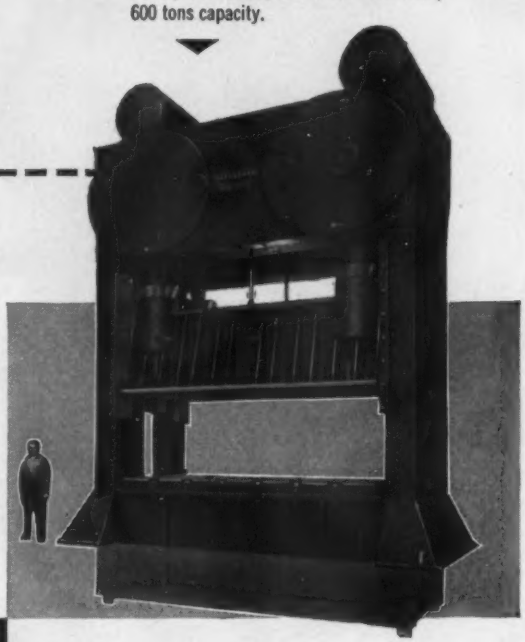
Less Down-Time With CLEVELAND Presses

Powered by the Clutch that's

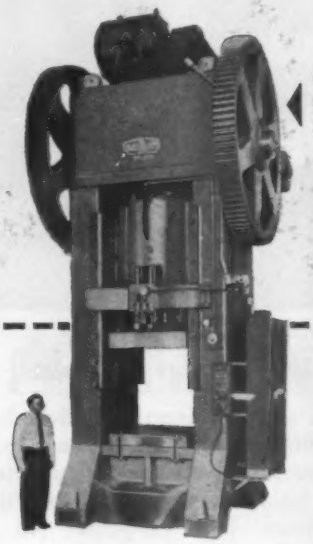


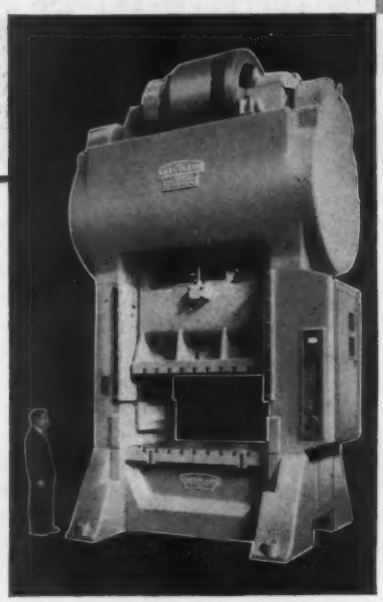
"Revolutionizing" Production

Cleveland S 4-600-204-102 Four Point Press, 40" stroke, 102 x 204" bed area, 600 tons capacity.



Cleveland S 1-800 Single Crank Press double geared, 16" stroke, 48 x 42" bed area, 800 tons capacity.





Cleveland S 2-350-60-42 Double Crank Press, 8" stroke, 42 x 60" bed area, 350 tons capacity.

It doesn't matter which of the 11 types of Cleveland presses best meets your requirements. For as long as it is equipped with our patented Cleveland Clutch, you can be confident that you are getting a press that will give you the best performance obtainable. This proven clutch unit assures minimum down-time, positive, fast control and lower operating costs.

Designed with a minimum number of parts, the patented Cleveland Drum Type Friction Clutch requires only minor adjustments. There is less chance of failure. Its light-weight construction reduces horsepower required for operation. Operational studies prove it to be completely dependable.

Why not investigate the production economy built into every Cleveland Press Equipped with our patented Cleveland Drum Type Clutch. Won't you let us give you the complete Cleveland story? Write or call today!

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AA-2137

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Nebel gap lathes give your assorted turning jobs the ole 1-2

Nebel removable block gap lathes give you (1) standard engine lathe turning plus the bonus of (2) extra swing capacity. The 16"/27" model, for example, gives you 9" extra swing within a 15" wide gap. 48% more capacity! Yet it costs only a few dollars more than the average engine lathe!

With this bonus capacity, the Nebel gap lathe frequently does the work of two engine lathes, yet occupies the floor space of just one machine. Why buy less, when Nebel's your best buy? Sizes 16"/27", 20"/30" and 25"/40". The Nebel Machine Tool Corp., Cincinnati 25, Ohio, U.S.A.

As a gap lathe. *With the blocks removed, the Nebel gap lathe can accommodate big, odd-shaped jobs that would normally require a larger lathe.*

From the *American Machinist* Library of *Tips for Top Shop Men*

GET to know your people *before* you have to get tough with 'em. It's poor policy to make their acquaintance by bawling 'em out. Introduction by insult is no longer a successful management routine.

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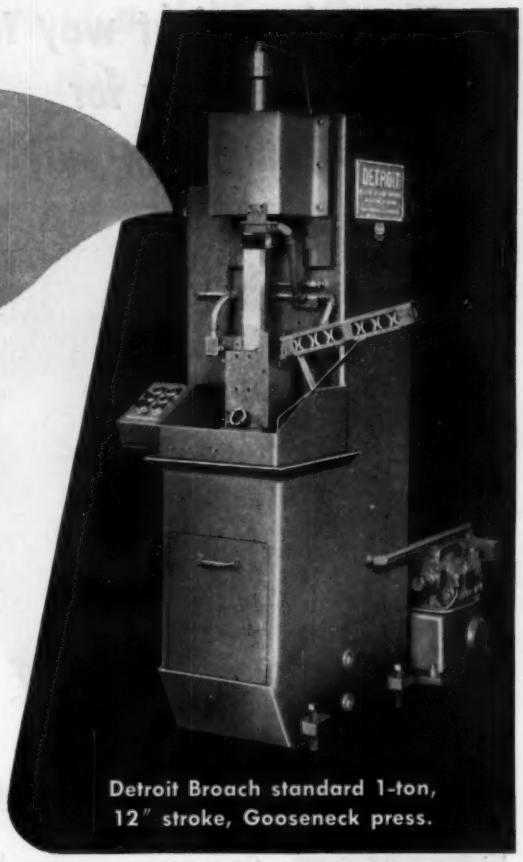
broaches oil groove in

700 BEARING RACES/Hr.

This application shows the versatility of Detroit Broach standard presses. Tooled for automation, parts are magazine fed from the preceding operation, broached and then dropped into a tote basket ***without an operator.*** Parts can also be chute-fed to next operation.

An important advantage of this type of automation lies in the fact that if the operation should be obsoleted, this standard press can be applied, without change, to another operation.



Detroit Broach standard 1-ton, 12″ stroke, Gooseneck press.

Detroit Broach standard 10-ton, 30″ stroke, Side Plate press.

STANDARD DETROIT PRESSES

for BROACHING ★ ASSEMBLING ★ STRAIGHTENING

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Detroit Broach COMPANY

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Alcoa offers the answers here...

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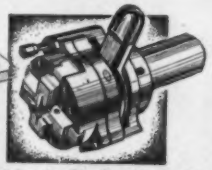

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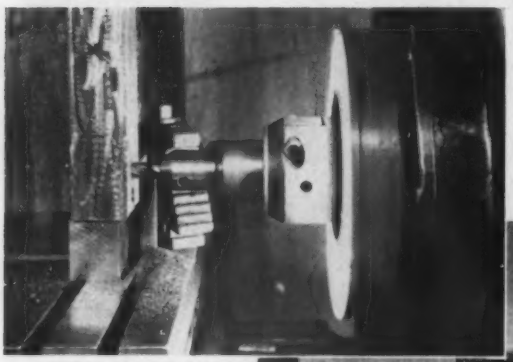
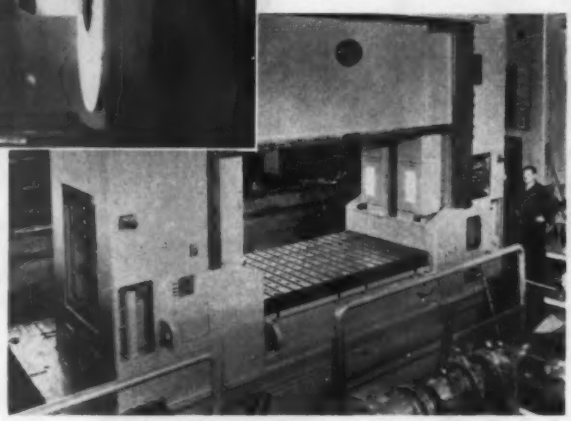


Circline Unit No. CLM16 on Boring Mill. Note light on vertical surfaces.



Presslite Units Four No. PL420 units installed on Large Forming Press.

Sun-Lite CIRCLINE UNITS

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American Machinist published Bi-weekly with an add'l issue in mid-November at New York, N. Y., for Oct. 1, 1955.

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Machine Shop Assistant needed by medium sized heavy process machinery manufacturer. Young college engineer graduate with some experience preferred. Position has a future. First duties will cover rate setting, carbide tool development and assist in increasing productivity. Company has liberal profit sharing plan. Salary open. Location S.E. Penna. Reply P-7616, American Machinist.

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Production facilities and small financial assistance required for patented machine with good sales potential. Involves conventional operations for machine weighing 3500 lbs. Will consider royalty or other suitable arrangement. BO-7929, American Machinist.

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(Classified Advertising)

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BOILER WORKS, San Diego, Calif. area. Handles work for many lg. companies. On call 24 hrs. Xlnt. profits. Compl. equip. Choice ind. loc. w/rr siding. Illness forces sale at low price. **Dept. #22395**

ELEC. MOTOR SERVICE No. Calif. in top ind. city. Netted $5,500 last yr. Ideal loc. Compl. equip. Priced far below value. Terms. **Dept. #22449**

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MACHINE SHOP, W. Cen. Wash. Netted $9,042 last yr. w/sales higher this yr. Top franchises. Estab. 1918. Other interests force sale at low price. Terms. **Dept #22488**

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MFG. & SALE OF MARINE HDWE. & SERVICE, So. E. Texas. Mfg. and sells new nets for shrimp trawls & repairs nets, sells marine hdwe, lg. bldg. compl. equipt., modern. Loc. in lg. fishing port, many tourists. Ideal buy, at low pr. **Dept. #6677-A**

MFGR., So. Calif. in Los Angeles area. Mfgrs. revolutionary new patented barbecue charcoal. Safe to use, easy to light, longer burning time, low price. Potentialities unlimited. All inventory equip., rights, promotional equip. etc. Underpriced at $15,000. **Dept. #22416**

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SASH & DOOR MFG. COMPANY, No. E. Texas. Mfgs. doors, moulding, furniture & mill wk. jobs. Lg. bldg. comple. equipt. w/rm. for expanding. Lg. potential area, rapidly grwing bus. Ideal opport. for ambitious buyer. **Dept. #6663-A**

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TRAILER MFG. CO., Los Angeles, Calif. area. Mfgrs. revolutionary new fibre glass caming trailer. Light weight, durable, give no road play at high speeds. Potentialities unlimited to the right buyer. $5,000 handles! Principals only, **Dept. #22444**

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4½" bar Sellers, Floor Type, Modern
4" & 3½" Bar Landis, Floor Type (2)
3¾" bar Defiance, Tble. Type, Late
3" Bar Universal, Tble. Type, Triway
GRINDERS, 12"x48" & 10"x96" Landis, Late (2)
60" Hanchett Vert. Spin., No. 300, Hyd., Surf.
Nos. 2B Reid, 3B Abrasive, Surf.
36"x42" Pratt & Whitney Die & Surf.
RADIALS, 4'9" & 4'13" Amer. Hole Wizards, '53
4'13" Col. Bick., New 1944
LATHES, 25"x192" Cen. L. & S., T.A., Late
18"-25"x102" Cen. Nebel, T.A., '43
14"-16½"x78" Cen. Monarch, T.A.
TURRET, Nos. 2 & 3 Morey—2, 3 W. & S.
SHAPERS—32" Cinci., '41; 24" Cinci. Univ., '40
SHAPER, VERT., 12" Pratt & Whitney, 1942
375 Allwood Rd Clifton, New Jersey
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9 16" Cleveland, m.d.
⅞" Cleveland Model B, belt
No. 6C Potter & Johnston, m.d.
14" Fay Flanders Type, m.d.
No. 8A Cleveland, m.d., 8" cap., latest
Model B—1-1/16" Cleveland, m.d.
Model A—1⅜" Cleveland Single Spindle, late
4 spindle 1⅝" Cleveland Model M, m.d.
No. 5 DELX Potter & Johnston, m.d., late
No. 6 DRELX Potter & Johnston, m.d., later type
2½" Cleveland, m.d., Model A
2" Cleveland Model A, single spindle, m.d.

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" Nuts
1" Landis Double Spindle, m.d. thru gear box
1½" Landis 2 spindle, late
1½" Landis 2 spindle, older type
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 326 Oster Bolt & Pipe Threading Machine, m.d.

HORIZONTAL BORING MILLS

#7 Barrett Horizontal Boring Machine
3" Universal Horizontal Boring Mill, m.d.
No. 23T Giddings & Lewis, m.d., late
No. 32 Lucas, m.d.
Barrett Double End, 7" and 5" spindles, m.d.
5" bar Ohio Table Type, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Newton No. 2 Cylinder Borer, m.d.
10" bar Sellers Floor Type, m.d.
Natco Horiz. Drill, with 2 spindles on one end, m.d., late
Floor Plates—all sizes

VERTICAL BORING MILLS

24" Bullard Spiral Drive, 1943
42" Bullard Spiral Drive, m.d., 1942
42" Bullard New Era, m.d.
42" King with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
44" Niles, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, md.
53" Niles Heavy Pattern, m.d., p.r.t.
73" Niles, m.d.
106" Niles Heavy, m.d., p.r.t
102" Niles Wheel Turning Boring Mill
12' Niles, m.d., p.r.t.

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d
12x72" Thompson Automatic Flat Broach, m.d
10 ton, 84" stroke Single Ram Vertical Surface Broach, LaPointe, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dual Ram Surface Hydr. Broach
Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.
Type 3L8 LaPointe Horiz. Hydraulic, m.d.

RADIAL DRILLS

2'9" col. Fosdick, m.d.
2½'-10" col. American Triple Purpose, m.d.
3'-9" col. Cincinnati Bickford, m.d.
4'-13" col. Fosdick, Ecgonomax Plain, m.d.
5'-14" col. Caritoo, m.d.
7'-16" col. American Triple Purpose, m.d.
7'-17" col. American, Universal Table
8'-17" col. American, Triple Purpose
8'-17" col. Dreses, gear box m.d.
Zawe Precision Universal Bench Type Radials, m.d., new
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 2 Avey Single Spindle, m.d.
No. 4 Fosdick, 8" overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. 18 Canedy Otto Bench Model, m.d.
No. ½, 1, 2 Avey, belted m.d.
No. 18 Edlund, m.d., new
No. 2 Avey Single Spindle, m.d.
2 spindle Allen, belted m.d., 8" overhang
No. 2LMS Leland-Gifford, single spindle, High speed, m.d.
2 spindle Avey, size No. 1, type B, style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland & Gifford High Speed, 8" overhang, m.d.
3 spindle Leland & Gifford #1LMS—High Speed late, m.d.
3 spindle Leland & Gifford High Speed, Model 3MS, m.d.
4 spindle Leland & Gifford, m.d. on each spindle
6 spindle Leland & Gifford, m.d. on each spindle No. 2 Taper

HORIZONTAL DRILLS

3 way Natco Horizontal Drill, consisting of 3 E13 Heleunits
No. ½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. ½Bx50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. 1½x185" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.

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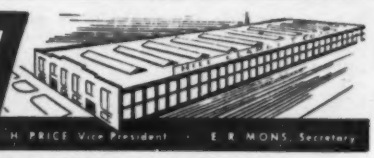

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Type D 16"-8 spdl. Bullard Mult-Au-Matic
6"-8 spdl. Goss & deLeeuw Chucker

BORING MILLS

100" Niles Vertical Boring Mill
Foote-Burt Vert., 5" dia. spdl., 20" sw. (1941)

BORING MACHINES

No. 49 Heald Borematics (1942)
No. 7-8" Bar Barrett Horiz.

DRILLS

1 spdl-14" sw. No. 2 Avey Cam Feed (1942)
1 spdl-24" sw. No. 2MA-6 Avey, pow. fd.
1 spdl-26" sw. No. 4 MS Leland-Gifford (hyd.)
2 spdl-24" sw. No. 3 Avey
3 spdl-24" sw. No. 2MS Allen, Tap & B.G. (1942)
4 spdl-14" sw. No. 2LMS L-G
4 spdl-26" sw. No. 2LMS L-G back gears
6 spdl-26" sw. No. 2LMS L-G Tap & B.G.
16 spdl-K60H Fox Multiple, (1944)

GEAR MACHINES

11" Gleason Gear Generator
No. 36BM Gould & Eberhardt
No. 615A Fellows Gear Shaper
No. 612A Fellows Gear Shaper
No. 65 Fellows, Cone Drive
No. 12HS Gould & Eberhardt

GRINDERS

No. 4H, 4"x12" Landis Pl. Cyl.
5"x30" Norton Cam-O-Matic (1946)
5"x42" Norton Type C Cam-O-Matic (1944)
6"x18" Norton Type C Plain (1942)
10"x18" Norton Type C (1941)
10"x36" Norton Type C Plain
10"x36" Norton Type C Cam Grinder
10"x48" Norton Type C Plain (1943)
14"x48" Landis Type C Plain
14"x48" Landis Universal
18"x36" Cincinnati Model ER Univ. (1942)
16"-26"x72" Norton Plain
18"x120" Norton Type A Plain
20"x96" Norton Plain
20"x32"x144" Norton Gap
20"x192" Norton Type A Plain
24"x264" Norton Type A Plain
Hill-Clarke Cylindrical Norton Type M.D.

10"x36" centers	14"x50" centers
10"x72" centers	14"x72" centers
10"x96" centers	18"x96" centers
14"x36" centers	22"x96" centers

No. TG615 J. & L. Thread Grinder
No. 81 Heald Internal Centerless
No. 74 Heald Internal Centerless
No. 72A3 Heald Univ. Internal
No. 72A5 Heald Internal (1942)
No. 72A5 Heald Bridge Type Int.
No. 5 Bryant Internal
No. 5A Bryant Hole & Face
No. 5B Bryant Internal
No. 16-16 Bryant Internal
No. 16A16 Bryant
No. 16-28 Bryant Internal
No. 16A28 Bryant Internal
No. 16F28 Bryant Internal
No. 16-38 Bryant Internal
No. 24-26 Bryant Internal
No. 24-36 Bryant Internal
No. 24L36 Bryant Internal
No. A3-16" Arter Rot. Surface
No. B24, 25" Chuck Arter Surface
No. 8 Hanchett Double End Disc
No. 214 Besly Double End Disc

FULL MONEY-BACK GUARANTEE

LATHES

12"x21" Fay Automatic
16"x21" Fay Automatic (1944)
16"x33" B-14 Seneca Falls
16 ML 16 LeBlond Semi-Automatic
14"x36" cc Amer. Grd. Hd., M.D.
27"x84" cc Amer. Grd. Hd., M.D.
36"x136" cc Putnam Grd. Hd., M.D.
No. 2 W. & S. Geared Head
No. 5W Acme Universal
No. 7A Jones & Lamson (1942)
No. 1A Warner & Swasey
No. 2A Warner & Swasey
No. 3AL Gisholt Cross Slide Tur.
No. 3H-10 Libby International
No. 4A Warner & Swasey M.D.
No. 4A Warner & Swasey (1944)
No. 4FU Fastermatics, Tur. Type

MILLING MACHINES

No. 36 Van Norman Pl., Swivel Hd. (1941)
No. 4 Cincinnati Dial Type Pl. (1942)
118 Van Norman Hyd. Mfg. (1942)
No. 06 Cincinnati Vertical (1942)
Briggs Mfg. Mill, 30"x8" Table M.D. (1942)
54"x30"x16' Ingersoll Slab
10"x60" Pratt & Whitney Thread
Model CT Lees-Bradner, 13" spdl. hole (1942)

PLANERS

60"x48"x27' American, 4 Heads
60"x48"x30' Hamilton, 4 Hds., A.C.
85"x72"x36' Gray, 4 Hds. Rev. M.D.

MISCELLANEOUS

No. 11RD 2 Head W. & S. Radial Tapper
No. 5A Kaufman Pneumatic Tapper
16" G&E Ind. Shaper
15"x18" Dill Slotters
Model 200 Micromatic Horiz. Hone
No. 224 Barnes Vert. Hone, 4" Cap.
No. 306 Barnes Vert. Hone, 6" Cap.
15 Ton American Hyd. Press
42"-16 ga. Economy Shear, M.D.

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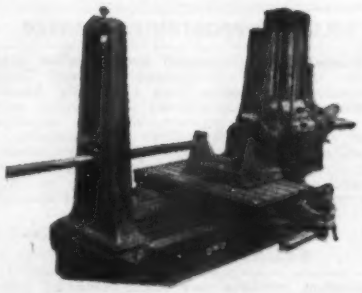
BORING MILLS
HORIZONTAL



DEFIANCE—4½"—Table—72 x68"
GIDDINGS & LEWIS—Mod. 45—4½ Cap.
GIDDINGS & LEWIS—#32—3½"—Cap.
LUCAS No. 1—3" Cap.
LUCAS No. 41—3" Cap.
LUCAS No. 42—4" Cap.
NILES BEMENT POND—3½"
UNIVERSAL 3" Capacity

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LATHES

No. 5 BARDONS & OLIVER Univ. Turret Lathe, 2" cap., Preselector.

27"x18' MONARCH "N" Geared Head Lathe, 11' centers, Taper Attach., Full Equipment, Late Type, 1942.

18"x10' MONARCH "BB" Grd. Hd. Lathe, 72" centers, Taper Attach., Flame Hardened Bed, Late Type.

24", 36", 42" BULLARD Vertical Turret Lathes, New Era, Turret Hd., Side Hd. M.D.

No. 2, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

24"x10' AXELSON Geared Hd., H.D. Model "E" 28" Actual Swing, M.D., Taper Attach.

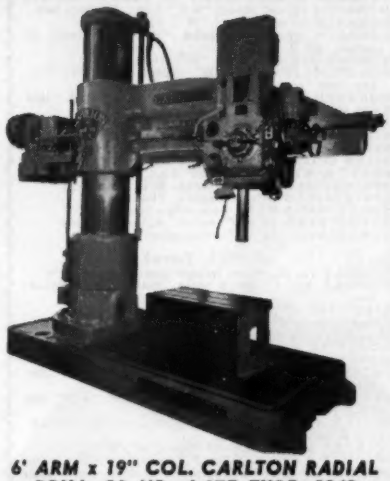
No. 7 BARDONS & OLIVER Universal Turret Lathe, 2½" capacity. Preselector Head.

DRILLING MACHINES

No. 262 BARNES Motor Driven Sliding Drill Press, 2" cap. in steel, 1941.

No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

3" UNIVERSAL Horizontal, Boring, Milling, Drilling Machine. Table Type Oil Grooved Table 32½" x 58"; 12 spindle speeds 16 to 650 RPM; 72" cap. to end support. M.D. Late Type.



6' ARM x 19" COL. CARLTON RADIAL DRILL, 20 HP., LATE TYPE, 1943

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D., Late.

No. 18 MARVEL Hydraulic Roll Stroke Power Hack Saw, 18" x 18" cap., M.D.

No. 92½-E TOLEDO Straight Side, Double Crank Power Press, 32" x 60" bed; 6" stroke. 100 Ton Capacity.

400 tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support. M.D.

No. 1, 2 BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

No. 5 NIAGARA O.B.I. Press, M.D.

No. 6 FEDERAL O.B.I. Press, 65 tons, cap., single geared, 4" stroke, M.D.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

36" ROCKFORD Hydraulic Openside Shaper, with Side Head, Late Type.

No. 20 WATERBURY FARREL Thread Roller, ⅜" cap. 1944, Motor Driven.

No. 8LS FELLOWS M.D. Gear Lapping Machine. Detachable Head, Univ. Work Support.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine. M.D. Late type.

10' x ¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

GRINDERS

No 14 WD HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS TOOL GRINDER, M.D., Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D.

6" x 18" LANDIS Type "C" M.D. Hyd. Cylindrical Grinder, Serial #29196.

#TG848 JONES & LAMSON Thread Grinder, Lathe, M.D.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

1A PRATT & WHITNEY Jig Borer, with Gauges, rods, Collets and Chuck.

4'x15" CARLTON Radial Drill. Motor on arm.

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2⅝" 6 spdl Acme Gridley automatic, 1941
12" x 46" Sundstrand type B auto lathes (2) 1947
7" No. 76H Baird automatic chucker, 1942.
36" and 42" Bullard vertical turret lathes.
No. 5-42 Cincinnati vert. duplex broach, 1946.
10 ton 36" Stroke American 10-T-36 Broach, 1949.
12" x 72" Colonial Broach grinder, late.
5" x 36" Colonial Broach grinder, late.
24 Spindle No. B2B Natco multiple drill, 1942.
25" Cleerman round col. upright drill, late type.
9' arm 16" Col. American motor-on-arm radial drill.
No. 2 Cincinnati centerless grinder, Filmatic bearings, ser. 2M2H2F21.
4" x 18" Cincinnati pl. hyd. cylindrical grinder, 1946.
6" x 18" Landis "C", 30° head cylindrical grinder, 1941.
6" x 30" Cincinnati "EA" Filmatic plunge cut cyl. grinder "2" 1942-43.
No. 72A Heald hyd. sizematic internal grinder, 1945.
13" x 60" Model 300 Hanchett vert. spdl. surface grinder, late.
43" No. 16A2 Blanchard 2-spdl. rotary surface grinder, 1947.
9" x 18" Hendey tool & gage-maker's lathe, 1940.
14" x 46" Hendey toolroom lathe, 1940.
26" x 10' bed LeBlond Heavy Duty G. H. engine lathe.
15" x 30" Lipe Carbomatic hydraulic lathe, new 1942.
17" x 5' bed LeBlond Rapid Production lathe, 1946.
No. 5 Jones & Lamson universal turret lathe, preselector, 1939.
No. 2-20 Kent Owens hydraulic mfg. mill, (2) 1942.
Model M24 Kearney & Trecker Mfg. mill, 1943.
Nos. 2B-3B-3H-3K & 4K Kearney & Trecker mills.
36" and 66" Rockford openside hydraulic shaper-planers (2).
48" x 48" x 10' Gray Maxi-Service planer, P.R.T.
2 Thru 70 Ton Knee type punch presses (dozens).
3 Thru 43 ton Open Back Inclinable presses
100 Ton No. 12-E Cleveland straight side press.
113 Ton No. 78 Toledo gap frame press.
126 Ton No. 306 Bliss straight side press.
260 Ton No. 795½—72 Toledo D.C. toggle press.
350 Ton No. 409C Bliss D.C. Toggle press.
500 Ton No. 1039 Hamilton D.C. press, 60 x 102 BA
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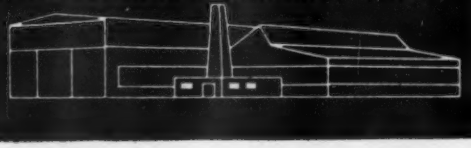

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EX-CELL-O No. 2112 single end, double spindle; late
GIDDINGS & LEWIS 340-T; 4" bar; late type
HEALD No. 47-A single end Bore-matic; late
HEALD No. 49 double end Bore-Matic; latest
LANDIS No. 35, 3½" Floor Type, motor drive
NILES 8" bar; floor type; motor drive
SELLERS 5" bar Table Type; late type

BORING MILLS—Vertical

BULLARD 8", 8-spindle Type "D" Mult-au-matic
BULLARD, 16", 6-spdl. Type"D" Mult-au-matic; late
BULLARD 24", vertical turret spiral drive; late
BULLARD 36" high speed 18" extra high column; latest
BULLARD 36", vertical turret spiral drive, late
CINCINNATI 54" "Hypro"; PRT; late type
NILES 53", 2-swivel heads; PRT; M.D.
NILES 36-44" Vertical Turret Lathe; late type
NILES 100" Heavy Duty Vertical; PRT, late
SELLERS 144", 2-swivel heads on cross rail; power rapid traverse, motor drive

GRINDERS—Cylindrical, Plain and Universal

BROWN & SHARPE No. 1 Universal; 10"x20" late
BROWN & SHARPE No. 2; Univ.; late
BROWN & SHARPE No. 4 Universal 14"x60"; late
CINCINNATI 6"x18" Pl., "Filmatic"; Mod. ER, late
CINCINNATI 14"x72"; Universal; Model ER; late
HARTEX 16"x60" Univ., model RHU-1520; New 1953
LANDIS 4"x12" Type "H" Hyd., Plain; late
LANDIS 10"x18" type "C" Plain; hydraulic
LANDIS 10"x36" Plain; motor drive
LANDIS 10"x36" type DC pl. hyd., infeed; m.d., late
LANDIS 16"x36" Type "C" Universal; late
LANDIS 20"x144" Plain Cylindrical Gap; M.D.
LANDIS "D" 25"x72" Crank Pin Grinder; late
LANDIS "C" 18"x72" Plain; late type
LANDIS type "C" 14"x72" Univ., late type
LANDIS type "DCP" 10"x72" hydr., late type
NORTON 4"x12" model CTU Plain; new 1953
NORTON 6"x18" Type "C" Plain Cyl.; late
NORTON 10"x36" Plain; motor drive
NORTON 10"x48" Type "C" Hydr., Plain, Cyl.
NORTON 16/20"x48" Plain, Cylindrical; late
NORTON 6/10"x18" Plain, Cylindrical; late
NORTON 16/26"x72" Plain, Cylindrical; late

LATHES—Engine and Mfg.

BRIDGEFORD 48"x10' Geared Head Lathe
GISHOLT No. 12 Hydraulic Automatic Chucker; late
HENDEY 18/24"x30" centers; Timken; late
HENDEY 24"x36" centers, M.D.; late type
JONES & LAMSON "FAY" 8" Auto. Timken; late
JONES & LAMSON "Fay" 20"x25" Auto., M.D.
LeBLOND Model 7ACL Crankshaft; 9"x30"; M.D.
LeBLOND 20"x48" centers; H.D. Timken; late
LeBLOND 27"x144" centers; motor drive
LODGE & SHIPLEY No. 3-A Duomatic; late
LODGE & SHIPLEY No. 5, 24" & 98" centers; DUOMATIC; Timken; late
LODGE & SHIPLEY 12"x30" G.H. Toolroom; late
LODGE & SHIPLEY 14"x30" Centers; late type
LODGE & SHIPLEY 16/20"x54", 18/22"x54" Toolroom; Timken; late
LODGE & SHIPLEY 18"x30", 18"x54"; Timken; latest
LODGE & SHIPLEY 20"x48", 20"x144"; Timken; late
LODGE & SHIPLEY 20"x54" Gap; Timken; late
LODGE & SHIPLEY 22"x48", 22"x96"; Eng., Timken
LODGE & SHIPLEY 24"x48"; Timken; latest
LODGE & SHIPLEY 24"x96"; Timken; late type
LoSWING4"x60", 4"x84", 8"x107" centers, late type
MONARCH 18"x48" Model CBB; late type
MONARCH 14"x42" centers; "Z" Magnamatic, Automatic; Timken, M.D., late
MONARCH 14"x54" centers; model AA; late
MONARCH 20"x144" centers; Model CM; (raises to Swing 31"); New 1947; late type
MONARCH 22"x264", 22"x336" cc. Model M; late type
MONARCH 12"x30" model "KK" Eng., Timken; late
MONARCH 24"x60" model "M", Timken; late
MONARCH 24/36"x48" model "N", air tracer; 60 series; late
MONARCH 16"x30" model "C", Timken; late
MONARCH; 18"x48" "CBB" (raises to 26½"); Timken; late
MONARCH 18"x72" "BB" (raises to 26"); Timk.; late
NEW HAVEN 42"x120" centers geared; M.D
NILES 30"x25', 30"x46' bed, Sgle. End Bor., "Timken"
NILES 30"x108" centers "Time Saver"; Timken
NILES 36"x100" c.c. "Time Saver"; late type
NILES 42"x216" centers Geared Head; late
PRATT & WHITNEY 16"x30" c.c.; Timken; late
SPRINGFIELD 14"x43" geared; M.D., late type
SPRINGFIELD 20"x48" centers, Timken; late
SUNDSTRAND 8"x15" Auto mfg., late type
SUNDSTRAND 10"x80" centers, Automatic; late
SUNDSTRAND 12"x22" Automatic; late type

LATHES, Turret

GISHOLT 1L, 2L Univ. Saddel type; Timken; late
GISHOLT No. 3; No. 5 Univ. Ram Type; Timken; late
LIBBY 1H6, 6" hole, long bed; late
LIBBY 4H-12" hole, M.D. Turret Lathe; M.D.
MAGDEBURG model MWF-250 Universal; late
MOREY No. 2 ram type, Timken; latest type
MOREY No. 4 ram type; Full Univ.; latest
POTTER & JOHNSTON No. 4D Auto. H.S., Timken; late
POTTER & JOHNSTON No. 4D-5 model "FC"; No. 4D-6 H.S.
POTTER & JOHNSTON No. 8DT Automatic Chucking & turning; late type
WARNER & SWASEY #1 "Electric", M.D., late
WARNER & SWASEY No. 2 Ram type; Timken; late
WARNER & SWASEY #1A; 3, 4, 4-A; Univ. Ram Type; late
WARNER & SWASEY No. 4, No. 5, Univ., preselector head, late

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NILES BEMENT POND 72"x72"x30'; 4 hds.; Power Rapid Traverse; D.C.; M.D.
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SOUTHWARK No. 1, 16' Plate Edge Planer; late

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BESCO Model EB2, 18½-ton Back Flywheel; New
BESCO Model EB4, 40-ton cap. Back flywheel; New
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BLISS No. 410A, 525-ton double action toggle drawing press; M.D.
METALWOOD No. 35A Univ. Arbor & Forcing Press
NATIONAL No. 5 "Maxi-Press" 1,000 ton cap., H.S. Forging Machine; M.D.
NIAGARA No. 66E, 35-ton Press; late type
ROGERS 150 ton Shop Press; latest type
V & O 30-ton O.B.I. Press; late type
WATERBURY FARRELL No. 9, 125-ton cap. Blanking Press; M.D.
WATSON STILLMAN 150-ton Horiz. Hydr. hand operated Wheel Press

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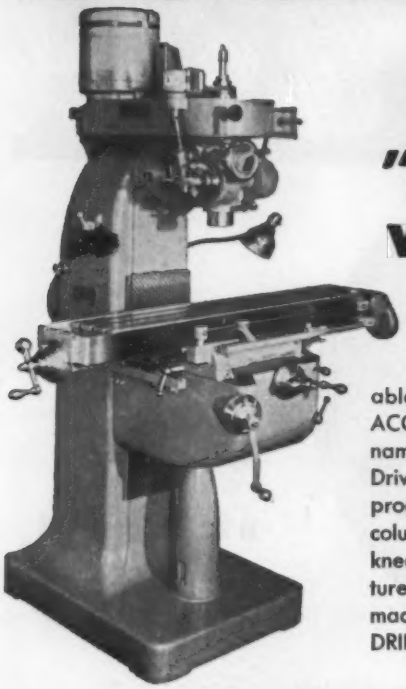

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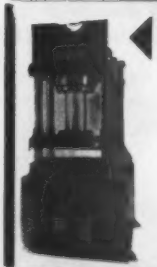

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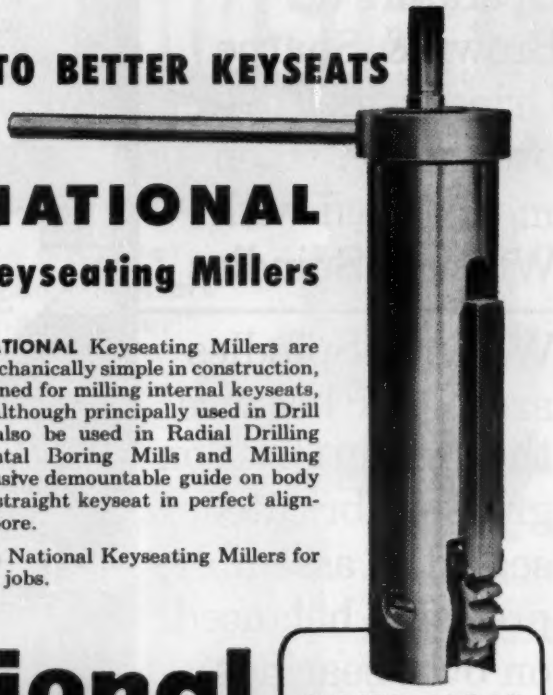

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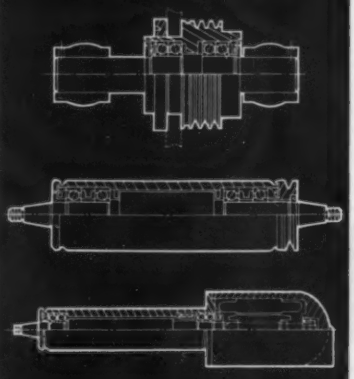

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Universal machines for internal gear and spline deburring. Data in Bulletin 103-81.

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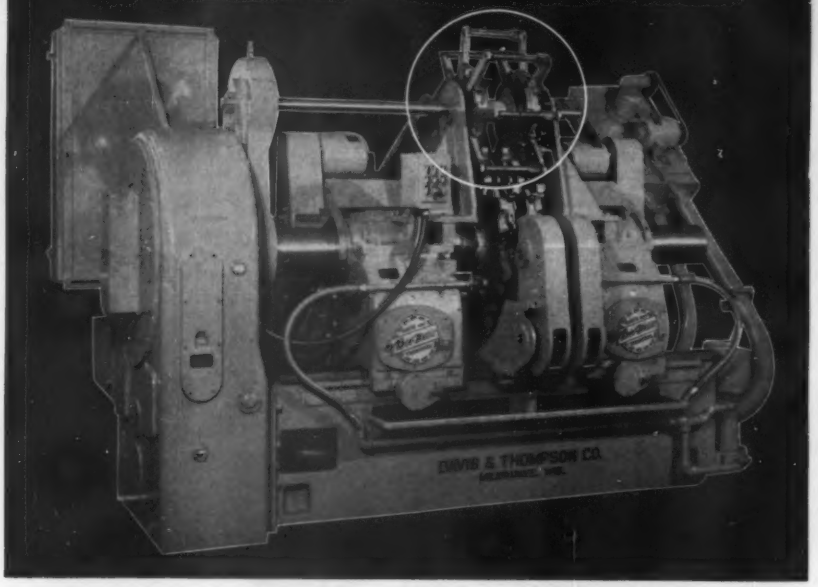

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Deeper penetration—less power consumption (2500 watts).
WALKER means greater lifting loads with power economy.
WALKER pioneer in magnetic applications . . . . Chucks—Demagnetizers—Special Auxiliary Plates—Holding Devices.

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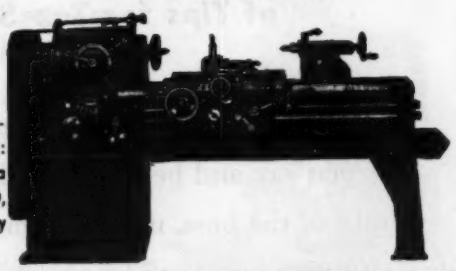

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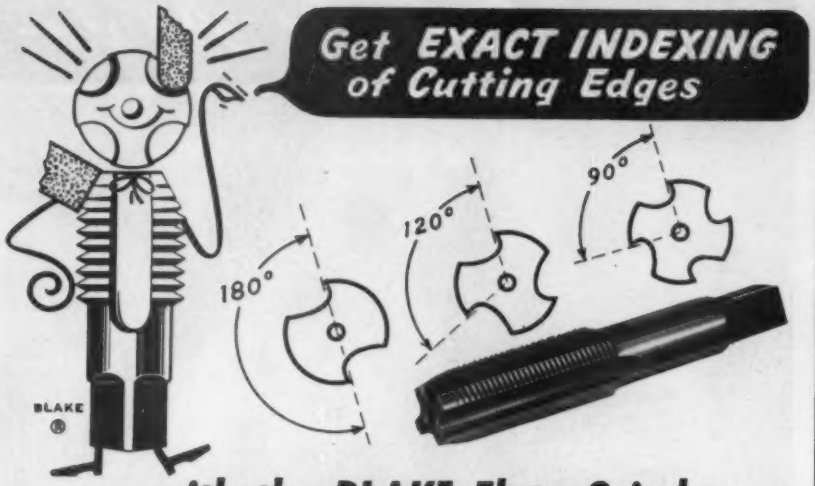

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From the *American Machinist* Library of *Tips for Top Shop Men*

BE MAN enough to stand up and fight for what you say and believe—or don't say it. If you're afraid of the boss, making remarks behind his back won't give you confidence.

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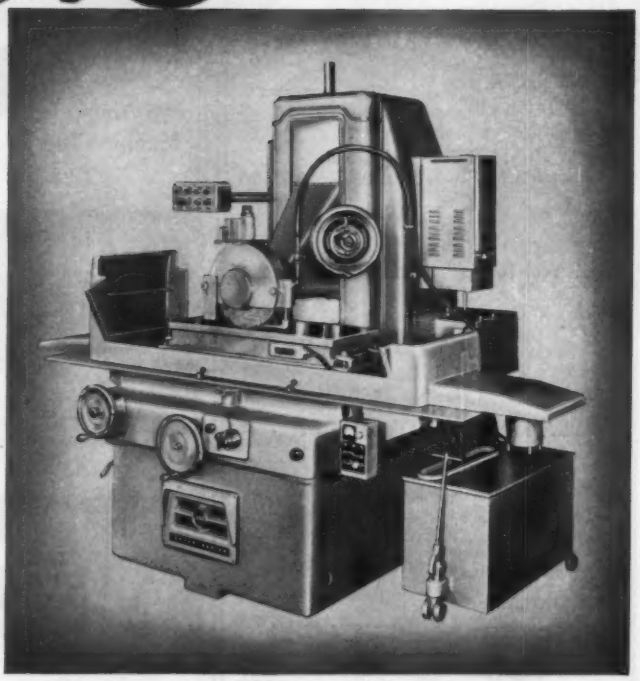

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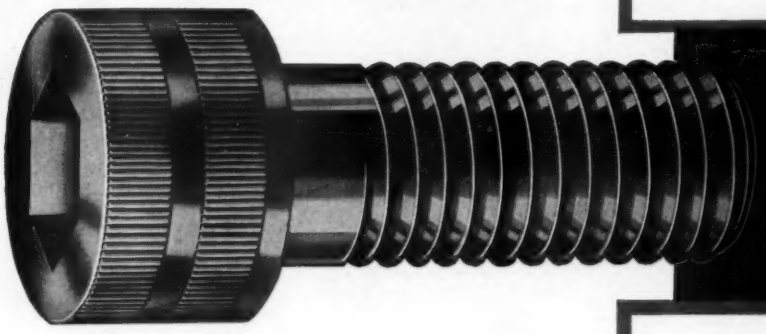

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Completely new Bullard Cut Master V.T.L. Model 75 uses TIMKEN® bearings to insure extra load capacity, top precision

TO reduce power losses and provide highest efficiency at point of cutting, The Bullard Company engineers chose Timken® tapered roller bearings for the Bullard Cut Master Model 75, a completely new design of vertical turret lathes. Timken bearings are used in the table, headstock, feed and traverse mechanism, side, ram and turret head drives and other applications throughout the machine. They have been selected to meet the service requirements at each vital point with maximum efficiency. From 160 up to 196 Timken bearings are used according to the number and types of heads selected.

Timken bearings have extra load-carrying capacity that results from line contact between rollers and races. Tapered construction permits preloading, so deflection is kept to a minimum, and constant accuracy is maintained. Radial and thrust loads can be carried in any combination. Timken bearings are geometrically designed to roll true and precision manufactured to live up to their design. They hold shafts in rigid alignment, insure accurate gear mesh.

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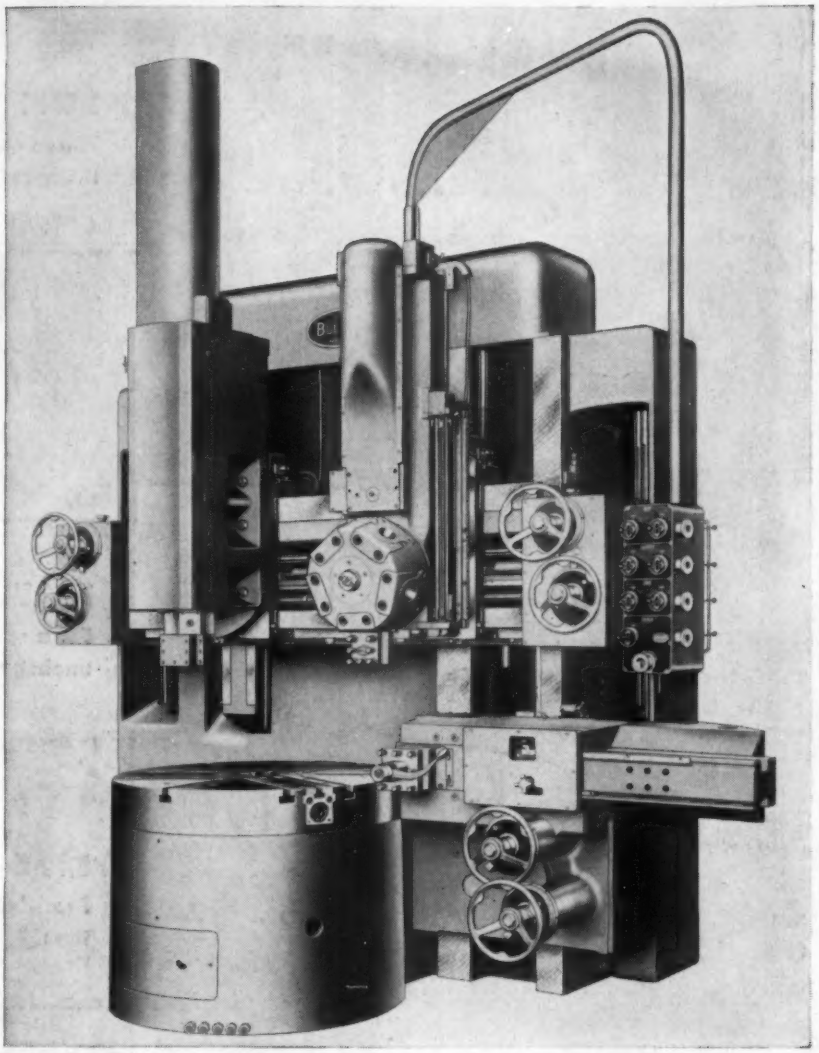
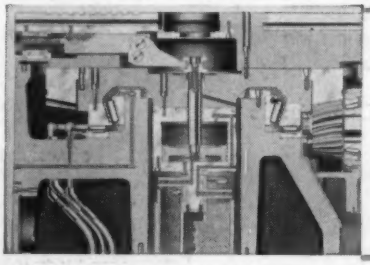
This symbol on a product means its bearings are the best





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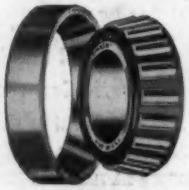

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